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TELEPHONE PATENTS.

THE success which has attended every endeavour on the part of the Bell and Edison interests in this country and in America to crush all forms of threatened competition, has not sufficed to keep would-be rivals from venturing into the field, even in the face of certain and determined litigation. Time after time we have had to record the appearance of a fresh candidate for public favour and telephonic honours; and time after time no sooner has an attempt been made to do business than it has fallen to our lot to report that the new-comer has been attacked by the owners of the Bell and Edison patents, and, as the sequel has shown, successfully attacked. Yet the cry is, "Still they come!" and our columns this week afford ample proof that inventors and improvers in this direction are not daunted by the fate which has met their predecessors. From America we learn that the "Pan Electric" and the "National Improved" Companies are prepared to wage "war to the knife;" and close at home we have the Irish telephone coming forward with its claims, such as they are, to attention, and prepared, we presume, to stand its ground and not give in without a struggle.

What the respective merits of the various instruments which now seek to oppose the established patents are we do not here intend to discuss. It is of more importance to examine the evidence and the trials generally in the previous cases, and try to arrive at some idea of the causes which have led to the uniformity of the decisions hitherto. Have they been just, every one of them; or have outside causes and influences conspired to pervert truth and equity? Few of our readers who are skilled in the matter will pretend to consider that the result of the past legal successes has been to establish in unprejudiced minds a belief in the invincibility of the patents holding the ground. Indeed, there are very many to be found who unhesitatingly assert their belief that even in those cases which have already been tried it has been conclusively shown that neither patentee, Edison nor Bell, was entitled to the broad reading of his claims which was insisted upon in his behalf. More litigation has taken place in America than in our own country upon this subject, but we have seen quite enough here to recognise the difficulty of contending against an established and powerful monopoly, and nowhere, we imagine, have more singular methods been resorted to, or more extraordinary arguments and claims been brought forward, than in the recent case of "United Telephone Company *versus* Bassano."

In the most recent cases we have heard little or nothing urged as to the invalidity of the existing patents. Anticipations were pleaded in the Bassano case, but no allusion was made to them on the part of the defendants. This seems a little extraordinary, when it is considered what strong grounds there are for believing that telephones capable of articulate speech existed previous to Bell's invention. If this point were presented with more pertinacity and greater force, we venture to think a different result might be brought about. Some of our contemporaries in the States believe that Reis's achievements have not been brought forward with sufficient prominence, and that it is capable of being proven that he designed and constructed instruments which transmitted articulate speech. The same belief is held here, and has been advanced in our columns by several of our correspondents, for whose benefit we reproduce the following testimony given in the recent case decided by Judge Wallace. A witness said: "The Reis telephone was first shown to me by Mr. Stephen Yeates, at a meeting of the Dublin Philosophical Society, held in November, 1865. He explained its construction and some modifications which he suggested and carried out. The transmitter was taken upstairs to a room, and the receiver placed in the hall, where I heard the voices of different speakers and recognised them. I also heard portions of musical airs, of which I recollect 'Home, Sweet Home,' 'Jump Jim Crow,' and 'God Save the Queen.' The sentences were short, such as, 'Who am I? Do you hear me? Who is speaking now?'"

The Pan Electric Company makes some bold assertions, with many of which we are inclined to agree. We quote two paragraphs from the bill filed by this company against the American Bell Telephone Company, and the second of these will form some sort of answer to our query earlier in the present article. "Fourth. That the Bell telephone patent of March 7th, 1876, is not useful; no telephones are used which are constructed in accordance with that patent. The Bell does not use its telephone, but uses the discoveries of others. No practical and useful instrument was ever in use constructed after the Bell patent. The patent is only used to litigate with. The ideas of others form and fashion the practical, commercial telephone." "Eighth. That the litigation on the subject has been of four classes:—1. Collusion suits. 2. Suits in which there were no contests or opposition. 3. Suits in which it was conceded that Bell, or his opponent in the suit, was the inventor, and in which the inquiry was, which of these was the first? 4. Suits in which the validity of the Bell patent was conceded, and the question was simply an infringement."

It is an error into which the Courts seem to have generally fallen, to consider Bell as the original inventor of the complete telephone. Giving him all credit for the inventions and improvements which are undoubtedly his, it is far from just to allow his claim—or the claim made for him—that he is entitled to monopolise all forms of telephonic instruments. This point is clear from a number of legal decisions. Judges have ruled frequently that if a person who

invents a new machine, never used before, and procures letters patent therefor, he acquires a monopoly as against all merely formal variations of his machine; but if the advance toward the thing desired has been gradual, and has proceeded step by step, so that no one can claim the complete thing, each inventor is entitled to his own specific form of device. Who shall say that Bell conceived the idea of an electrical telephone outright, without reference to or knowledge of previous experiments and achievements in the same direction? He contributed most valuably to the progressive development of the telephone, and is entitled to the emoluments to be derived from his labours. But to assert his right to shut out all others who have, contemporaneously with him or since, worked in a similar groove and produced results which, though valuable, and tending to the same end, are yet essentially different in detail, is to lay down a proposition which the English law has over and over again repudiated. As well claim for Gramme the sole right to the manufacture and sale of the dynamo machine, or similar rights for the first to bring into commercial use any other kind of machine which has arrived at its present state of efficiency through successive stages of invention and improvement.

ELECTRIC LIGHTING IN SOMERSETSHIRE.

SIR GREVILLE SMYTH having decided to adopt the electric light at his Somersetshire seat, Ashton Court, near Clifton, coincidently with the alterations and embellishments which have been in progress at the Court during the last twelve months, Thomas Dyke, Esq., his estate agent, consulted Mr. W. D. Gooch, Director of Electric Lighting at the International Exhibitions, South Kensington, as to the best means of carrying out the necessary work.

The following is a sketch of what has been accomplished, the installation throughout having been under the personal management of Mr. Sidney Sharp.

Motive Power.—A Crossley's twin 6 H.P. gas engine (indicating 28 H.P.), fitted with a self-starter.

Dynamos. — Two Hochhausen shunt-wound machines, by Messrs. Edmunds and Goolden of Halifax, each giving 105 volts and 85 ampères in external circuit at 1,100 revolutions.

Transmission of Power. — Oldfield and Walton's patent link leather belting.

Accumulators.—Fifty-four of the Electrical Power Storage Company's glass cells, 23 L plates; the battery coupled in parallel with the dynamos and lamp circuit, to act primarily as a regulator, also to supplement the engine power on special occasions, and to provide light in bed rooms and elsewhere when the engine is not running. This battery will maintain 70 20-C.P. lamps for eight or nine hours.

Engine Room Fittings.—The switch board, a specialité of the above-named company and made by it, is arranged with an accumulator switch, with "off," "on" and "ammeter" blocks; two dynamo switches having a similar arrangement, and closing automatically the field before the main circuit; a regulator switch for adding cells as required; and lastly, a lamp circuit switch. All these being connected to the positive terminals of accumulator and dynamos, there is no possibility of any inexperienced person making a short circuit, if interfering with the switches. Volt and ammeters are also affixed to the board. Two large Cunynghame magnetic cut-outs (by Messrs. Woodhouse and Rawson) protect the main cables.

Leads.—The mains, which are carried through the house a distance of 300 feet to the distributing board in the Buckhorn Corridor, are calculated at the rate of 625 ampères per square inch, with the maximum number of lamps on, viz., 250. Throughout the building the branch leads are on a similar, or more liberal basis.

Main Switch Board.—Placed in a central position is a large and handsome switch board, with mahogany case and locked glass door, made by Messrs. Paterson and Cooper; on its massive slate backing are fitted six Eidsforth switches, with as many Cunynghame magnetic cut-outs for the various sections of the house. Attached to the board is a Cardew voltmeter; but in order that the engine driver also may know at all times the difference of potential at this distributing board—which is rendered necessary by the fact that the switching on the various rooms will be under the management of the butler, and the number of lamps alight may vary from 1 to 200—the positive and negative bars of the switch board are put in connection with the engine room voltmeter; the driver then switches on or off one or more cells to maintain a constant pressure at this central point.

Arrangement of Lamps.—The lighting is almost entirely from the ceilings, and so arranged as to ensure an even distribution of light in any part of the rooms.

In the hall, drawing room and boudoir, the lamps in the ceiling are arranged symmetrically according to the designs of Messrs. Jackson and Graham of London, who have executed the alterations and decorations of these portions.

The ceilings of the south entrance, vestibule and museum are the work of Mr. J. Long, builder, of Bath, under the direction of Major Davis, architect, of the same city.

In the south entrance 20-candle-power lamps, with suitable glass shades, hang from the crowns of the richly carved groined stone roof, and give ·2-C.P. per square foot at a height of 11 feet.

A panelled oak ceiling has been erected in the museum; from certain intersections of the moulded ribs, 54 20-C.P. lamps are suspended, and yield a light of ·55-C.P. per square foot at 15 feet 6 inches from the floor.

In asbestos-lined boxes let into the stone walls, behind opening oak panels, are the switches which regulate the quantity of light, beginning at 6 lamps, and increasing by twelves distributed throughout the room, to the full number. Lamps for the keyboard of the organ are also provided.

Turning from the south entrance through its open arches to the conservatory: here, 20 single wrought iron foliated pendants with flowers to receive the incandescent lamps (designed by Mr. Biddle of Messrs. Jackson and Graham, and skilfully turned out by Messrs. Weyman & Co., engineers, of Guildford), give finish to the light iron frame of the roof. These 20 lamps (20-C.P.) are equivalent to ·35 C.P. per square foot. In the rockery and waterfall some few lamps peep out. The entrance porch has three in a ruby glass globe; one alone can be left on guard all night, if desired.

The ornamental design of the hall ceiling in bold relief takes the lamps close up to the scroll at a height of 16 feet. There are 8 20-C.P. and 24 10-C.P. lamps arranged in two circuits, the C.P. being ·57 per square foot.

The vestibule leading into the dining and drawing rooms has 7 lamps as finials to the raised ornamentation of the ceiling; the illumination at the height of 12 feet being ·37 C.P. per square foot.

On entering the drawing room greater brilliance is observed. The panelling being of dark oak, and the frieze also dark, a liberal allowance of light is required. Here, again, the design of the ceiling marks positions for lamps, and bosses occur at certain positions to receive them.

The grouping of the lamps on the ceiling consists of 4 stars of 5 Bernstein 50-C.P. lamps, the intermediate spaces being occupied by 10-C.P. lamps. Each star of five has its switch concealed behind a movable panel;

the 10-C.P. being governed by one switch. Altogether, the 20 50-C.P. and 32 10-C.P. give ·7 C.P. per square foot at a height of 13 feet.

On the walls of the dining room are four single wall brackets of severe design (from the Anglo-American Brush Corporation) with pretty shades, reflecting light on to the carving table and sideboards; whilst the dining table is illuminated by means of a pair of very handsome seven-armed candelabra, glow lamps taking the place of candles; the direct rays of light are carefully shaded from one's eyes and reflected on to the table. Under the carpet are let in two of Mr. Tayler Smith's pin floor connectors. Flexible wires lead from these through the table to the base of each candelabra, where a similar connector is provided, but with three pins, so that either the central 20-C.P. lamp or the 6 10-C.P. can be lighted, or all of them.

In the study are fitted some elegant single and double wall brackets of Messrs. Faraday and Son; also Mr. Tayler Smith's wrought iron reading lamps, which hang and stand in so many positions, and are with their flexible wire and wall connectors, movable from room to room.

On the first floor one enters the boudoir, where, distributed on a very pretty ceiling, a dozen lamps throw down their rays. The decorations being of a light tone, the candle-power, ·33 per square foot, gives an excellent result. Wall sockets of the Brush Company, to take incandescent lamps, or plugs with flexible wires, are let into the walls of this room, as well as elsewhere, for reading or piano lamps.

The neighbouring bed room has double brackets over the toilet glass and over the fireplace. A lifting and lowering silk parachute lamp with cords and tassel matching the decorations (made by Messrs. Faraday and Son) hangs down from the ceiling near the toilet glass. In addition to these may be mentioned a lamp over the bedstead, a movable reading lamp by the fire, and one in the top of the bath, each one having its own switch.

The dressing room adjoining is fitted somewhat in the same way; and the Natural History room beyond has a 3-light electrolier, and an inspection lamp with flexible wire running off a reel. The brackets in these rooms are by Messrs. Verity and Sons, King Street, Covent Garden.

The upper and lower corridors and landing are fitted with Messrs. F. and C. Osler's wall brackets and cut glass globes.

Over the broad staircase, where it divides to right and left, hangs a massive chandelier with four arms, each carrying a duplex oil lamp. The wicks are gone, and carbon filaments have taken their place. Through the glass globes the change is unnoticeable, but the action of a switch behind the panels reveals the secret.

A turret staircase and sundry other places also have their lights.

Fusible plugs in great number, in addition to the magnetic cut-outs for each section on the main switch board, and the magnetic cut-outs on the main cables, render the installation exceedingly safe; whilst all the details of wiring have been carried out carefully in accordance with the requirements of the insurance offices.

Numerous switches in the different apartments enable the occupant to vary the amount of light as desired. These switches being on the return or negative wires, whilst those on the main distributing board are on the positive, any portion of the system can be completely cut off from the rest.

The following is a summary of the lamps:—

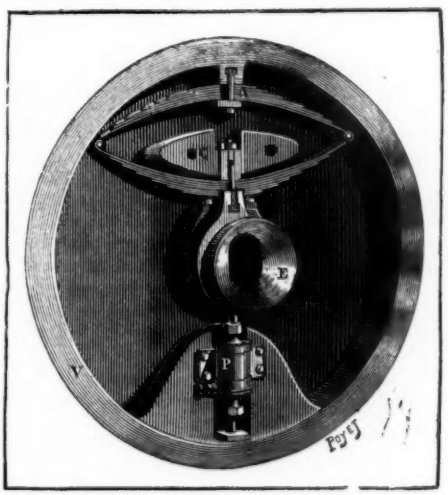
20	Bernstein	50 volt	50	C.P.
160	Anglo-American Brush	100 „	20	„
12	„ „	50 „	10	„
24	„ „	25 „	10	„
32	Woodhouse and Rawson	25 „	10	„

We are indebted to the courtesy of Mr. Sidney Sharp for the interesting information herein contained.

THE GRÉVIN MUSEUM ELECTRIC LIGHTING.

SINCE last April the Grévin Museum has been lighted by electricity. The installation, by the Edison Company, is very complete, and affords an example of all the cases in which the new mode of illumination can be applied.

On approaching the museum the visitor, says *La Nature*, is enabled to judge of the effect produced on a large open space; two Cance lamps illuminate the boulevard, and can be seen at a great distance. These are the only arc lamps employed, all the others being of the incandescence type. In the rather long corridor which leads to the entrance of the museum there are only three lamps; there the eyes may rest and prepare themselves for the visit to the interior; the light produced is just sufficient to enable us to find our way, and to render all the more conspicuous above the door, at the end of the corridor, the fan light which is illuminated by three lamps placed on a reflector of silvered glass. Finally, in the interior winter gardens, landscapes, saloons, scenes of theatres, trinkets of the ballet dancers, &c., show that the electric light can be made to supply all wants. We have also the proof that it can be installed everywhere, even in an ancient locality, where nothing had been prepared for its reception, and situate in the busiest and most frequented



part of Paris. The machinery is erected in the basement, and an opening in the wall places the machine room in communication with the other rooms of the basement. The latter contain already a certain number of objects much appreciated by the visitors; this machinery forms another, and not the least interesting, attraction. The boiler is not visible, it is erected in another room. To the right of the steam engine we notice, against the wall, a Bourdon lubricator. The steam, on issuing from the boiler, passes through this lubricator and becomes thus charged with the necessary lubricant. At the further end of the room, in front of the visitor, is an apparatus arranged for the distribution of the current ever the different circuits, which are fed by the dynamo machine which is seen at the left (fig. 2).

The boiler, constructed by the firm of A. Collet & Co., produces 1,000 kilogrammes of steam per hour. Its heating surface is 55 square metres, and the grate surface is 2 square metres. It is 2·25 m. long by 1·75 m. wide, and its height does not exceed 3 metres. This type of multitubular boiler is of a very original construction, on account of the arrangements adopted for the grouping and fixing of the tubes. They are of a slightly conical form at their extremity, and are closed by plugs equally conical, against which they are pressed

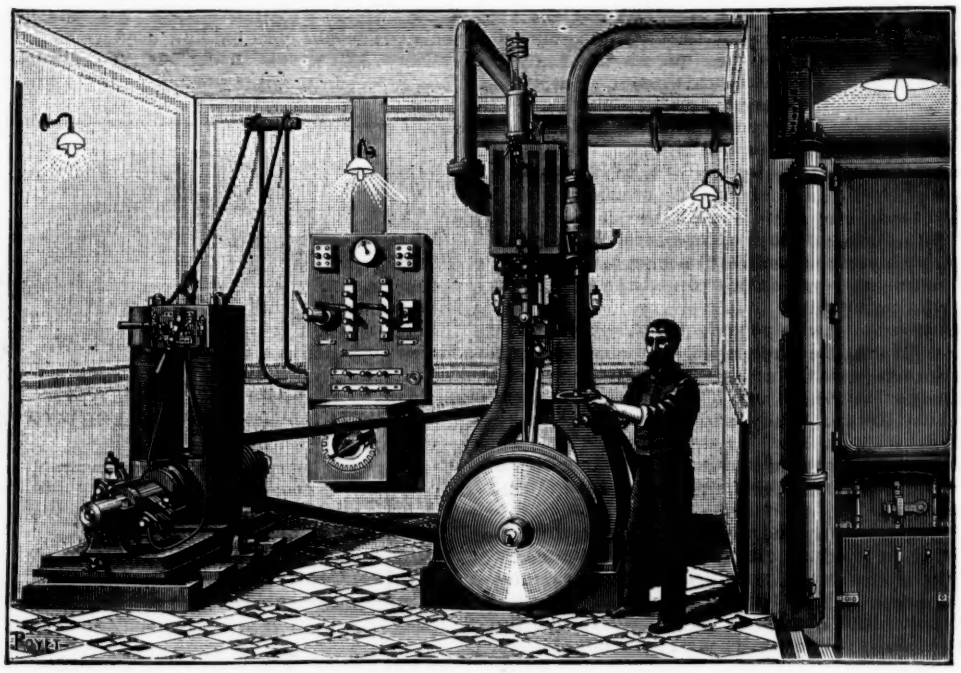
by a long bolt which passes through them. In this way it is very easy to take down and replace a tube. In front they communicate with each other by means of vertical boxes provided with partitions and interior tubes of thin sheet iron, which arrangement allows the steam to circulate freely, and almost without being accompanied by water. A special drier placed on the top of the boiler completes the drying process, and the introduction of water into the engine is thus avoided. The yield of this boiler may be estimated at 9 kilogrammes of dry steam for each kilogramme of fuel consumed.

The steam engine has been constructed by Messrs. Leconteux & Garnier. The piston is placed vertically on the frame, and the steam is distributed by means of a circular slide valve. The engine is of 50 H.P.; it has been very carefully constructed; all its parts are grouped so as to occupy the least possible space; its total height is 2·50 m., its greatest breadth 1·30 m. The speed is 300 revolutions per minute; all the parts subject to friction are of steel, and their surfaces made true by filing. The governor is the invention of the constructors of the engine, and merits a special description. It cannot be seen on the engine; it is placed

This governor has given good results; the engine regulated for a speed of 305 revolutions per minute when running free, has made, when doing work, 299 revolutions.

The dynamo machine is by Edison, with bar electromagnets, whose coils form shunts to the main circuit. It is of recent construction, and the only one of its type in Paris. Its speed is 900 revolutions per minute, and it is capable of feeding 400 lamps of 16 candle-power each, whose constants are from 100 to 110 volts and 0·75 ampère. Its total height is 1·56 m., and its greatest breadth, including the driving pulley, is 2·10 m.

The dynamo machine feeds three circuits; one in the basement containing 54 lamps, of which 28 are of 16 and 26 of 8 candle-power. They illuminate "The History of a Crime," "The Burial of a Carthusian," "The Laboratory of M. Pasteur," "The Ruins of Ischia," &c. The second circuit lights the upper storeys, and the third circuit is on the ground floor, where it is subdivided into secondary circuits, two of which feed the Cance lamps; in this case the current is led through resistances consisting of two bobbins of German silver wire for regulating purposes.



on the inside of the fly wheel, which also acts as a driving pulley. The governor is shown in fig. 1. It is based on a displacement of the eccentric which is fixed, as usual, on the arbor of the fly wheel. E is an opening which allows the eccentric to slide in the direction of a straight line situated in a plane perpendicular to the arbor. This sliding motion is regulated by a guide fixed on the fly wheel. The governor is attached by rigid bars to a weight on one side, and on the other side to a piston, whose cylinder is filled with oil, and which acts as a hydraulic brake. The weight is maintained in a certain position by means of a spring, A. When the engine is in action it is evident that the weight has a tendency, imparted to it by the centrifugal force, to leave its position, this tendency being the greater as the speed of the engine increases. It drags away the eccentric, C, to which it is attached; the effect of this is to modify the radius of eccentricity, and consequently the action of the slide valve; that is to say, the periods of admission, compression, and expansion of the steam. The spring brings the weight back to its normal position as soon as the speed decreases, and in this way all sudden movement is avoided.

Each of the other secondary circuits is specially used for the lustres and lamps of the saloons of the ground floor. Each part is thus rendered independent, and can be lighted or extinguished by means of a switch. Each lamp can also be extinguished simply by unscrewing the button of its cut-out.

The number of lamps actually in use is 170 lamps of the type A and 204 lamps of the type B, representing in all 4,350 candles. The capacity of the machine allows the lighting of more lamps if necessary, either for the service of the museum or for the illumination of establishments in the neighbourhood.

This installation is deserving of notice, because it shows so clearly the facility with which the electric light adapts itself to all kinds of illuminations, and particularly the advantages which it has from a decorative point of view.

Telephonic Litigation in America.—An interesting extract from a trans-Atlantic contemporary bearing upon this subject will be found in our present issue. Probably something advantageous to inventors in this country may be gleaned therefrom.

TELEPHONIC LITIGATION.

IN view of the interest excited by the trial of the recent case *re* telephone infringements before Mr. Justice North, we publish under a letter from Mr. W. Van Beuthuysen, of Wankesha, Wis., written to the New York *Electrical World*. Mr Van Beuthuysen is interested in the "National Improved" telephone, and he indicates the line of attack in the case pending against that instrument. He writes :—

"You have been pleased to mention in your issue of July 18th that I am reported by the Pittsburgh papers as being much exercised at the result of the great suit of the American Bell *versus* the Western Pennsylvania Telephone Company. I think it only just that my reasons for being exercised should be given, which are as follows :—

"1st. The offensive partisanship of the Court, as evidenced by its comments and insult to the defence, in hearing the two days' argument of plaintiffs, and then practically telling the defence that it made no difference what it might show, as its decision was in favour of plaintiffs.

"2nd. The error in taking the decision in the 'Spencer,' 'Dolbear' and 'Dowd,' or 'Western Union Telegraph' cases, as making Bell 'the discoverer of the art of transmitting speech by electricity,' when said decisions were, in the two first cases, based upon admissions that Bell was the first to discover that 'art' (which is not true), and in the last-mentioned case on the same admission in consideration of which the Western Union Telegraph Company gets one-fifth of all the royalties received by the 'Bell' Company, which amounts to millions of dollars per annum.

"3rd. Because the Court, on the plea of 'judicial comity,' conformed to these decisions without weighing the evidence presented, or ascertaining conclusively that these decisions, upon these untruthful admissions, were not binding upon the public or other contestants.

"4th. Because of the vicious feeling shown by the Court in destroying between sixty and one hundred thousand dollars' worth of property, and depriving a large number of persons of employment, by refusing to accept a bond for any amount of security, when, according to complainants' own showing, they had suffered a loss of the rental of only sixty-five instruments. I had no interest in this property, but I think the total destruction of an exchange of 700 actual subscribers, under such circumstances, shameful.

"5th. Because the following evidence presented by the defence was ignored without the slightest consideration :—

"Speech is not transmitted by any 'invention' of 'Bell,' the 'Blake' transmitter now in common use being an improvement on the 'Edison,' which Mr. Edison says is an improvement on the 'Reis,' and as the 'Blake' transmitter was in common use in this country three years before being patented, it is therefore void as a patent.

"The claim that 'Bell' invented the 'magneto telephone' when he had the 'magneto board telephone' of 'Reis' before him, which is a perfect transmitter and receiver of articulate speech, is preposterous.

"'Bell' knew of the 'electro-magnet' with a metal inductive plate in front of it, or perfect 'magneto telephone,' used by Professors Pickering and Cross (which fact the Bell Company strenuously endeavoured to hide), and therefore his claim for what he knew was old vitiates his patent.

"No one objects to Bell having a patent for any device he invented. Objection is made only to his being allowed 'the discovery of the art,' or a 'monopoly,' when he was not the discoverer of the art.

"Originally no such exclusive claim was ever made under the Bell patents, and it was only after the decision in the Spencer case, upon the admission that 'Bell' was the first to discover the art (which is not true) that any such claim was made.

"It is admitted by every respectable electrician in the world that the Reis instrument, as made in 1862 to 1865, and the improvements thereon by Yeates, Vander Weyde, Pickering and Cross, long before Bell was known as an inventor, all transmit and receive speech successfully.

"To show that 'Bell' is not the discoverer of the art, the defence offered to operate the original 'Reis,' 'Vander Weyde,' 'Pickering,' 'Cross,' and other instruments older than 'Bell's' (the court-house having been wired for that purpose), and a large amount of testimony was offered, from which the following extracts are made :—

"Affidavit of Dr. I. Hofmann, Consulate of Paris, France :

"Dr. Hofmann says he was present at a lecture (by Philip Reis, in Giessen, Germany, September, 1864), on an instrument Reis named the 'telephone,' and that 'there cannot be the slightest doubt that words were transmitted and successfully reproduced by the apparatus, and this aroused great enthusiasm,' the following professors being present : Magnus, Müller, Eisenlohr, Bohn, Wiedemann, Holzmann, Weber, Reusch, Greis and Ottengen.

"*Jahres bericht des Physikalischen Vereins zu Frankfurt am Main fur das Rechnungs jahr*, 1860–61. Published in 1862, pp. 57-64, on 'Telephony' by Means of the Galvanic Current, by Philip Reis.

. . . . "'How, indeed, could a single instrument reproduce the combined effect of all the organs occupied in human speech?' . . . . 'Hitherto it has not been possible to reproduce the tones of human speech with a distinctness *sufficient for everyone*. The consonants are for the most part reproduced pretty distinctly, but the vowels, as yet, not in an equal degree.'—*Journal of the German-Austrian Telegraph Association*, v. 9, pp. 1, 35, 36, 1862.

"'The operation of the apparatus is as follows :' . . . . 'By speaking into it or by singing or introducing the tones of an instrument' . . . . 'Chords and melodies were transmitted with marvellous accuracy in the practical experiments hitherto made, *while single words in reading, speaking*, &c., were less distinctly recognisable, although even in these the inflection of the voice, as interrogation, exclamation, surprise, calling, &c., were clearly reproduced.'

"'Reis's' prospectus from 'Pisko.' Pisko's *Neue Apparate der Akustik, Wien*, 1865, p. 241.

"'Besides the *human voice* there can be produced, according to my experience, just as well the tones of good organ pipes.' . . . . .

"And in speaking of the magneto call attached to the 'Reis' instruments, Pisko says :—

"'Simple signals can, by agreement at both stations, be given by opening and closing the circuit one, two, three or four times. For example : one stroke = sing ; two strokes = *speak*.'

"*Dingler's Polytechnic Journal*, vol. 169, p. 399, 1863:

"'The experimenters could even reproduce words.'

"Translation from *Didaskalia*, May 12th, 1862 :

"'Mr. Reis gave a historical outline of the origin and development of his idea of the practical possibility of the transmission of tones in a galvanic way.'

"*Deutsche Industrie Zeitung*, 1863, Chemnitz, No. 9, April 17th, 1862 ; No. 16, p. 83 and p. 184 :

"'Mr. Q. writes us that by means of the telegraphic conductor with which the apparatus of Mr. Philip Reis was connected, two remote parts of the city were united.'

. . . . . .

"'All present capable of judging, Mr. Q. adds, who availed themselves of the opportunity of witnessing the experiments, agreed that the possibility is before us of making one's self understood verbally at any distance in the way shown by Mr. Reis.'

"*Handbuch der Angewandten Elektricitaetslehre* von Karl Kuhn, 1865, pp. 1017—1021, p. 97, 98 :

"'The working of the two apparatus, ... the transmitter being placed at one station and the receiver at the other, is as follows : By speaking, singing or . . . . in the practical experiments made thus far, it was possible to transmit with astonishing faithfulness

chords, airs, &c. While reading, speaking, &c., single words were more indistinctly heard.'

"Now if any honest man can say, after reading the above few extracts of testimony and testing the 'Reis' instruments and the improvements thereon made long before Bell's patents were issued, that 'Bell" was the first to discover the 'art of transmitting speech,' particularly when the Bell instrument under which the claim is made never did and cannot transmit speech when made as described by Bell, and when the Bell device was undoubtedly copied from the Reis-Legat board receiver, the Vander Weyde 'electro-magnet' and 'knitting needle' receiver with metal induction plate, described in *Manufacturer and Builder* and New York *Tribune* of May, 1869, and the Pickering-Cross 'electro-magnet' receiver, deposited in Boston School of Technology since 1872, all of which transmit and receive speech distinctly, while Bell's instrument, as described by him, will not, then I will admit that I have no grounds for being exercised, and that the whole world is wrong and the 'Bell Company' right.

"In conclusion, I beg leave to add the following interesting addition to the history of the 'telephone' and the methods thereof, taken from the Bell Company's chief expert's affidavit (see the defendants' record, Pittsburgh case, page 76):

"Q. Have you a copy of such testimony?

"A. I have had what purported to be a copy of that testimony, but I never compared it with the original. It is not at present in my possession, as I loaned it out some time ago, and it has not yet been returned to me.

"Q. Can you get it in your possession so that it may be produced here to-morrow?

"A. I think it very doubtful if I can do so.

"Q. Can you tell me who has possession of it?

"A. It was lent to Professor Pickering since the last examination.

"Q. Have you taken steps towards getting your copy of that testimony back into your possession?

"A. Several days ago Professor Pickering told me he would return it shortly, and thinking it might be wanted I sent for it last night. After leaving this office this morning and going to my study, I found that it had been left on my desk. I have placed it in the hands of complainants' counsel, Mr. Roberts, to use as he sees fit.

"This affidavit refers to testimony in the 'Harmonic' case which had been suppressed. No comment is necessary, except to say that, like the 5th claim of the Bell patent, it '*covers broadly*.'"

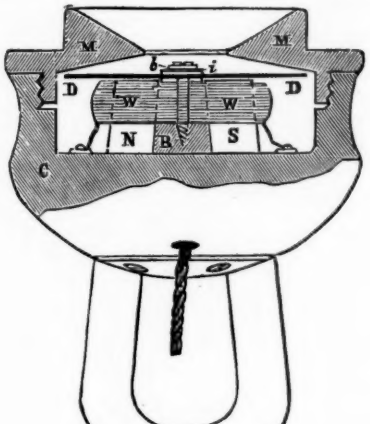
The *Scientific American*, commenting upon the recent decision of Judge McKennan in the suit against the Western Telephone Company at Pittsburg, to the effect that the prior decisions of Judges Gray and Wallace must be held to be an estoppel against the hearing of further argument in his court on behalf of the defence upon matters previously passed upon by those judges, although the defendants were prepared to introduce testimony to prove that their invention was substantially the same as that used by Philipp Reis many years prior to Bell's invention, says:—"The practical effect of this decision is that the use of the Reis telephone is an infringement of the Bell patent—a position which we have expected the lower courts would sooner or later take, since in no other way can the gigantic Bell monopoly be upheld. The moment justice is done, and the use of Reis's invention be allowed, the patent of Bell will be reduced to its proper rank—that of a subordinate improvement. None of the Bell telephone litigations have reached decision by the Supreme Court. If the latter tribunal deals with the Bell patent in the same manner that it has with other wide-reaching monopolies, the claims of the Bell people will, in due time, be greatly modified."

Upon this the *Electrical Engineer and Electrician* remarks:—"We have no authority to speak for the owners of the Bell telephone patents, but we hazard very little in saying that any person or corporation choosing to engage in the business of making, selling or using the Reis telephone, constructed as Reis constructed it, need not feel alarmed about their business being interfered with by the 'gigantic Bell monopoly.' The trouble appears to be that the courts are unable to see the justice of permitting the defendants in the case to construct telephones like Bell's. When somebody is enjoined from making and using a Reis telephone, unaided by patented improvements of later date belonging to others, it will be time enough for a scientific journal to assert that it is an infringement upon the Bell patent."

IRISH'S TELEPHONIC APPARATUS.

ON Saturday last we were invited to inspect and experiment with the telephonic apparatus invented by Mr. Irish of Sunderland, and which were exhibited in London by Mr. N. Macadam.

We understand that the instruments which are here described are considered to be without the claims of Edison and Bell; but so were those of Bassano and Slater until the decision of Mr. Justice North upset such opinions. The peculiarity of this system, however, is that the transmitter and receiver are identical in their action, and interchangeable, just as are Bell's instruments; but here the similarity ends. In Bell's apparatus the diaphragm or tympan, capable of inductive action, is held down all round its edges and vibrates in the manner of a drumhead; but the inductive plate in the telephone constructed by Mr. Irish is free at its edge and firmly held in the centre. In the



illustration, C is a wooden case with an earpiece or mouthpiece, M, screwed therein. N, S, are the poles of a horseshoe magnet, between which is a block of wood, B. The fine wire, W, is not wound around each pole separately as is usually the case, but is wrapped around both poles so as to form but a single coil. The plate, D, of ferrotype metal, free all round its edge, is screwed to the wooden block, B, by a small screw which passes through a small brass collar, *b*, and India rubber rings, *i*.

The transmitter, which we do not consider it necessary to illustrate, is enclosed in the usual wooden case, to which is attached the ordinary switch, bell push, &c. The magnet is somewhat larger than that in the receiver and is laid flat in the back of the case, the two coils, wound separately and joined up in series, projecting from the faces of the poles and not from the ends.

The diaphragm is also of greater diameter than that of the receiver, their respective sizes being $3\frac{3}{4}$ inches and 2 inches.

On the occasion of our visit the instruments were connected within the same building, and we imagine that Mr. Irish does not intend them to be used over long distances. The talking was very articulate, but not loud, this latter quality being scarcely to be looked for in the form of apparatus employed.

MEASURING LIQUID RESISTANCES.

By MM. BOUTY AND FOUSSEREAU.

TWO methods have been proposed as furnishing exact measurements of the resistance of liquids: the one, founded upon the employment of electrometers, and of which we have made use in previous researches, is beyond all criticism, since it absolutely eliminates the influence of the polarisation of the electrodes; the other consists in weakening the polarisation until it may be neglected, increasing the useful surface of the electrodes as much as possible and having recourse to alternating currents of the shortest duration possible. This method has been frequently employed abroad, especially by M. F. Kohlrausch.

Desirous of ascertaining the comparability of the results obtained by these two methods, we made use of a small Marcel Deprez motor revolving with the speed of 100 turns per second, and we directed the currents which it yielded into a Wheatstone bridge, or an excellent Ader telephone was substituted for the galvanometer.

First Experiment.—The four branches of the bridge are entirely metallic: we obtained them from resistance boxes of the firms Elliott, of London, or Breguet. It is absolutely impossible to regulate the bridge in such a manner as to render the telephone silent. Three branches of the bridge, A, B, C, being equal to 10,000 ohms the minimum sound corresponds to D = 9,300 ohms. If we take C as unknown, the ordinary calculation of the bridge gives its value with an error of 7 per cent. For A = B = 10,000 ohms, C = 100,000 ohms we find D = 80,000 ohms, the relative error being 20 per cent.

Second Experiment.—On replacing in succession one, two, or three, metallic branches by non-polarisable liquid resistances formed of strong solutions of zinc sulphate with electrodes of amalgamated zinc the experiment is much improved, without, however, obtaining good extinctions. It is no better on forming the fourth branch of a kind of rheostat of sulphate of copper with filiform electrodes.

The special induction of the bobbins in the former experiment and the polarisation of the small electrodes in the latter introduce into the bridge parasitic electromotive forces. Hence there results a cause of systematic errors which, perhaps, has not been entirely avoided by experimentalists. The method of alternate currents can only be applied if (1) *we exclude from the circuit every metallic non-rectilinear resistance*, especially the resistance boxes of commerce, and if (2) we employ, even in strong solutions only electrodes with a very large surface.

In order to effect measurements under such conditions, we made use of a sulphate of copper rheostat of which the arrangement is as follows: two test jars placed one above the other, A and B, full of sulphate of copper, contain each a copper electrode having several square decimetres of surface. The two jars communicate by a vertical tube, into which enters a solid glass rod almost equal in section, which is inserted at pleasure, and the exact position of which is noted by means of an index and a graduated scale. We measure, by means of continuous currents of very feeble intensity, the resistance of the rheostat corresponding to each degree of the scale, and we can then use the apparatus for absolute measurements. It is necessary to know the temperature of the liquid as the resistance of copper sulphate varies by $\frac{1}{30}$ of its value at 0° for each degree C.

The liquid resistance to be measured is formed of two vessels, each containing an electrode of platinised platinum of 1 square decimetre surface and communicating by means of a syphon full of the same liquid as the vessels. The fixed branches of the Wheatstone bridge have an analogous arrangement, but the electrodes are amalgamated zincs, plunging into a strong solution of sulphate of zinc.

Under these conditions we obtain with the telephone absolute extinctions of noise, and the results of the measurements agree sensibly with those furnished by the electrometer. The relative precision is so much the more moderate as the resistances are greater. For instance, whilst the relation of the resistances of solutions of chloride of magnesium and chloride of potassium has been found to the $\frac{1}{1000}$th in two consecutive measurements with the electrometer as 1·546 and 1·541, the method of alternating currents, applied to the same liquid at the same temperature gave 1·609 and 1·586 as the value of the same relation.

The mean values obtained by the two methods do not differ more among themselves than do two individual measurements of the same relation furnished by alternating currents, but with the electrometer the precision of the measurements is much greater. It seems even very difficult to apply with some degree of success the method of alternating currents to the very dilute or highly resisting liquids which we have had occasion to study formerly.—*Comptes Rendus.*

THE ELECTRIC LIGHT IN WARFARE.

IN the archives of the artillery and engineers of the German army there are certain prescriptions relating to the use of the electric light in time of war. A correspondent to *La Lumière Electrique* extracts from them certain details, which present a general interest from a technical point of view.

As regards the limit of distance at which the electric light can be utilised we must always, in determining this distance, take into account the total road traversed by the rays of light (direct rays emanating from the source of light and rays reflected by the object illuminated). Experiments made for this purpose in the course of the year 1879 have given the following results:—

Distance of the object illuminated.		Total distance traversed by the luminous rays.
From the source of light.	From the observer.	
8,000 metres.	50 metres.	8,050 metres.
7,800 „	100 „	7,900 „
6,000 „	600 „	6,600 „
1,500 „	4,300 „	5,800 „

Some further experiments made with a very powerful lamp, in order that it might be possible to take aim at objects, gave the following figures:—

Distance of the object illuminated.		Total distance traversed by the luminous rays.
From the source of light.	From the observer.	
6,000 metres.	3,900 metres.	9,900 metres.
3,400 „	6,500 „	9,900 „
4,000 „	6,500 „	10,500 „
6,000 „	4,500 „	10,500 „

In searching out points to be aimed at with the aid of the electric light, it is recommended to employ simple reflectors with a dispersion apparatus. On the occasion of some reconnaissances of ground made in 1879 at Portsmouth a dispersion apparatus of this kind rendered excellent service. At a maximum distance of 2,400 metres the ground illuminated had the width of 700 metres, the angle of dispersion being 6° 42′, whilst without a dispersion apparatus the ground could only be illuminated over a breadth of 100 metres.

As regards colours, it has been naturally found that light colours are more easily recognised than dark ones. Here is an observation made at Portsmouth in 1879: on the extreme point of a promontory there was fitted up an electric lamp which illuminated, at a distance of

900—1,000 metres, three boats gradually approaching the coast. One of these boats was white, the second varnished white, and the third black. The crew of this last had their hands and faces covered with lamp black. The two first boats were distinctly visible ; the third was only seen at the distance of 500—600 metres, and would not have been perceived at that distance but for the reflection of its wake. At 400 metres it appeared only like a spot, and its colour became distinct only at 10.

In certain other experiments they proceeded in the following manner :—Several groups of six persons were illuminated at different distances ; two of each group were dressed in white, two in blue, and two in red. The experiments were made in a large meadow at the foot of a long hill, on which were a windmill, a church steeple and a fortress. The results are given in the following table :—

Kind of machine.	Kind of reflector.	Observation.	685 metres.			914 metres.			1,143 metres.			1,372 metres.			Mill. 1,680 metres.	Steeple. 1,680 metres.	Fortress. 2,900 metres.
			White.	Red.	Blue.	White.	Red.	Blue.	White.	Red.	Blue.	White.	Red.	Blue.			
1.—Two Gramme machines A. G. of 500 candles each ; combined, acting in derivation.	Manschen. 0·60 metre diameter with hand regulator.	Naked eye ...	D	D	B	D	...	...	...	...	...	...	...	...	D	D	...
		Telescope ...	D	D	B	D	D	B	...	...	...	D	...	...	...	...	...
2.—Two Siemens machines D_2 combined, acting in derivation.	Siemens-Sotter (catadioptric lantern), with automatic lamp.	Naked eye ...	D	...	B	D	...	...	D	...	...	I	...	...	D	...	...
		Telescope ...	D	D	...	D	...	...	D	...	...	I	...	...	...	...	...
		Naked eye ...	D	E	...	D	...	...	D	...	...	I	...	...	...	...	...
		Telescope ...	D	...	...	D	...	...	B	...	...	...	...	...	D	B	...
3.—Gramme machine D_2 4,000 candles.	Manschen. Diameter 0·90 metre, with hand regulator.	Naked eye ...	D	D	...	D	D	...	D	D	...	D	D	...	E	D	I

The signification of the letters is given as :—D, distinct ; B, bad ; E, exact ; and I, inexact. [The meaning of "exact" as compared with "distinct," and of "inexact" as compared with "bad" is not explained.]

Certain experiments made in Austria on the effect of paralysing the action of electric light projectors are to be noted as particularly interesting.

According to these experiments it would be possible, by directing a cone of electric light normally to the conical bundle of rays by which the spectator is illuminated, to produce, so to speak, a shadow behind which he cannot be perceived.

A source of electric light is a very difficult mark to hit, as it dazzles the eyes of the gunners, and the elevated position of the luminous point is a cause of error in calculating the distance.

THE PULL OF THE TONGUE OF A TELEGRAPH RELAY.

THE force with which the tongue of a telegraph relay is actuated is smaller than might be at first supposed. Thus I have found by actual measurement that the pull of the tongue at the contact points with a current through one coil of a Post Office standard relay* is equal to

$$\frac{\text{current in milliampères}}{128} \text{ ounces,}$$

and with a new non-polarised compound relay the pull at the contacts with a current through one coil is about

$$\frac{(\text{current in milliampères})^2}{6400} \text{ ounces.}$$

These figures will of course vary somewhat in different instruments according to the adjustment ; but approximately the average standard relay produces a pressure at the contact points of $\frac{1}{16}$ ounce with 8 milliampères flowing through one coil ; and 24 milliampères through one coil of the new non-polarised compound relay produces a force at the contact points of about $\frac{1}{12}$ ounce. The springs of the new non-polarised compound relay produce a pull at the contact points of about $\frac{5}{32}$ ounce, that is equivalent to the pull of 30 milliampères.

The force necessary to overcome the friction of the tongue of a relay I have found to vary much in different instruments, and it is very much greater in polarised than in non-polarised relays ; this fact is probably owing to the attraction of the inducing magnet for the tongue increasing the friction in the polarised relays. Of several standard relays tested, the force of friction varied from $\frac{1}{32}$ ounce in a relay clogged with dirty oil, to rather less than $\frac{1}{128}$ ounce in a relay recently oiled.

W. MOON.

* See ELECTRICAL REVIEW, March 15th, 1880.

THE PRACTICAL CALIBRATION OF AMPEREMETERS.

THERE exist a great number of methods for effecting the calibration of ampèremeters. One of those most frequently used consists in passing a constant current for a given time through the instrument to be calibrated and through an electrolytic trough : the weight of metal deposited makes known the strength of the current. To be exact, the method is nevertheless long and troublesome, especially if we wish to determine the current strengths corresponding to a certain number of points of the graduation.

We shall indicate, writes M. Hospitalier in *L'Electricien*, two simple and rapid methods which give results sufficiently accurate for practice, and which are especially adapted for the frequent verifications and re-standardising of industrial elements of measurement, verifications the necessity of which we have recently shown.

The two methods require a standard element and resistances perfectly adjusted ; for the former there is also needed a graduated galvanometer, such as the galvanometer with a movable frame of the Deprez-d'Arsonval construction. The second requires merely a sensitive galvanoscope.

First Method.—We begin by calibrating the movable frame galvanometer by regulating the shunt and the

resistance in circuit so as to give it 50 divisions per volt on each side of the scale. When this is done we arrange in circuit an accumulator, the ampèremeter to be graduated, a fixed and known resistance in thick nickel silver wire—we ordinarily employ a resistance of 0·1 ohm formed of a wire of 6 millimetres in diameter—and a rheostat of variable resistance, the only object of which is to cause the strengths of the current to vary. The movable frame galvanometer, previously calibrated, is mounted in derivation at the extremities of the fixed known resistance. By properly manipulating the rheostat we bring the needle of the ampèremeter to the different points of the graduation which we wish to establish or verify, and determine the difference of potential in volts at the terminals of the known resistance, by taking the sum of the two readings on each side of the scale. We deduce from this the corresponding current strength by applying Ohm's law. On operating rapidly, a resistance of 6 millimetres in diameter suffices to calibrate apparatus up to 60—80 ampères; for as the current only passes into the bobbin for a few seconds at each reading, there is not time for it to become heated sufficiently to vary the resistance sensibly. Beyond 20 ampères it is necessary to modify the standard of the movable frame galvanometer by doubling or quintupling the resistance of its circuit, so as never to exceed 100—120 millimetres on each side of the scale, a limit beyond which the readings cease to be proportional to the current strength.

Second Method.—This is an application of the potentiometer of Clark, which as apparatus requires merely an unimportant modification of the bridge of graduated wire, now so commonly used.

We prepare a series of nickel silver wires of different diameters and of 105—110 centimetres in length, and determine exactly for each of them the resistance per metre. To calibrate an ampèremeter we put in the place of the ordinary wire of the bridge one of these resistances already known; in one of the arms of the bridge we intercalate an accumulator, and in the other arm the ampèremeter to be calibrated, as also a rheostat intended for varying the strength of the current.

Between the movable contact and one of the extremities of the wire we intercalate a sensitive galvanoscope and a standard battery in opposition to the difference of potential existing between the two points where it is attached. The contact is made to slide upon the graduated wire in one or other direction until the galvanoscope is at zero. At this moment the difference of potential between the extremity of the graduated wire and the sliding contact is equal to the electromotive force of the standard element. We read off on the divided scale the length of the wire comprised between the two points, we deduct the resistance, and we have thus all the elements for calculating I.

The method is very rapid and may be applied even with an easily polarisable standard cell like that of Latimer Clark. The series of wires of different diameters is for the purpose of always permitting the readings on the graduated scale, whatever may be the strength of the current.

We may otherwise employ the method without any modification of the bridge of divided wire and without changing the wire, on condition of knowing its resistance. It is sufficient to shunt this wire with a known fixed resistance, proportionate to the current strengths to be measured, and to operate as above.

Let R be the resistance of the graduated wire of 1 metre in length; S the resistance of its shunt; E the electromotive force of the standard; I the strength of the current; l the length in metres comprised between the sliding contact and the extremity to which the battery is attached.

When the equilibrium is established we have the relation:

$$I = \frac{E\,(R + S)}{l\,R\,S.}$$

When we have not at disposal a divided wire bridge, it is enough to have a simple stretched wire of some metres in length, the resistance of which per metre is known. We move along this wire the two extremities of the circuit formed by the standard element and a sensitive galvanoscope until the latter is at zero. We measure the distance between the two points of contact and calculate by the formula:

$$I = \frac{E}{l\,R}$$

I, E, l have the same significations as above. R is the resistance per metre of the extended wire traversed by the current to be measured. The method is very rapid; we may judge its accuracy by the fact that an error of 5 millimetres in the length of 1 metre gives a value of the intensity exact to $\frac{1}{100}$. We shall study the calibration of voltmeters in a future article.

THE SIMULTANEOUS DETERMINATION OF BATTERY CONSTANTS.

IT is a well-known fact that the fall of potential between points in a closed circuit varies directly as the resistance between those points. This is true even when the resistance includes the seat of the electro-motive force of the circuit, as in the electrolyte of a galvanic cell or the armature of a dynamo. Some time ago I (Prof. W. L. Hooper in the *Electrician and Electrical Engineer* of New York) devised a method, founded on this principle, of measuring the resistance of batteries, but afterwards found that I had been anticipated by Kempe. The key that I used has, however, never been described. It is similar to the double key frequently used with the Wheatstone bridge, excepting that over the lower arm, A, is a cross-bar, D, in metallic contact with it when the arm is in its normal position. In use, one terminal of the battery is connected to the pin, E, the other to a condenser; the same terminal of the condenser is connected through a delicate reflecting galvanometer to the cross-bar, D, the other terminal to the lower arm, A. When the key is pressed, the condenser is charged; when released, the condenser is discharged through the galvanometer, from the throw of whose needle the electromotive force of the cell may of course be calculated.

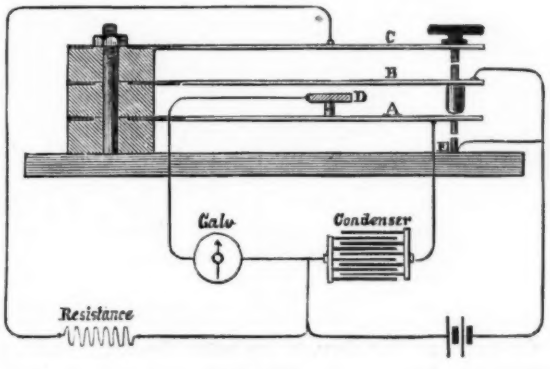


FIG. 1.

The poles of the battery are then connected through a known resistance, best approximately equal to the resistance of the battery, to the two upper arms, B and C, and the difference of potential again observed by pressing the key. The known resistance must of course include the contact resistance between B and C.

If E is the electromotive force of the battery, E′ the difference of potential between its poles when the circuit is closed, R the internal resistance, and V the known external resistance, we shall have:

$$\frac{E}{E'} = \frac{R + V}{V}$$

whence R is easily calculated.

As the circuit is only momentarily closed, there is no time for polarisation to occur; and as the condenser, excepting whan the key is pressed, is always short circuited through the galvanometer, there is no chance for a residual charge to accumulate in it. I have found no method so expeditious and trustworthy; indeed, by it the resistance of the cell is obtained almost as quickly and with but little less accuracy, than that of a coil of wire with the Wheatstone bridge.

Everyone who has had much to do with batteries has of course noticed the more or less rapid decrease of current from a cell coupled up with a small external resistance. It has been usual to attribute this decrease of current to the opposing electromotive force of polarisation. Now, the current in any circuit is a function of two variables—the electromotive force and resistance; and in a battery circuit, when the external is small, variations of internal resistance may be nearly as effective in changing the current as variations of electromotive force itself. In certain cells with which I have experimented, I have felt sure that the decrease of current was not altogether due to polarisation, but partly to altered resistance, owing to changes in the composition of the electrolyte. So far as I know, no method has been devised that would enable one to simultaneously determine both electromotive force and internal resistance of a battery in action, and that, too, without appreciably interfering with the arrangements of the circuit. I have, therefore, sought to devise a method that would enable one to obtain a practically continuous record of the electromotive force and internal resistance of a battery during the whole or any part of its entire life.

For this purpose I added another arm to my old key, and placed a cross-bar over each arm, four in all. The key is connected to battery, known resistance, two condensers, and two galvanometers, as shown in fig. 2.

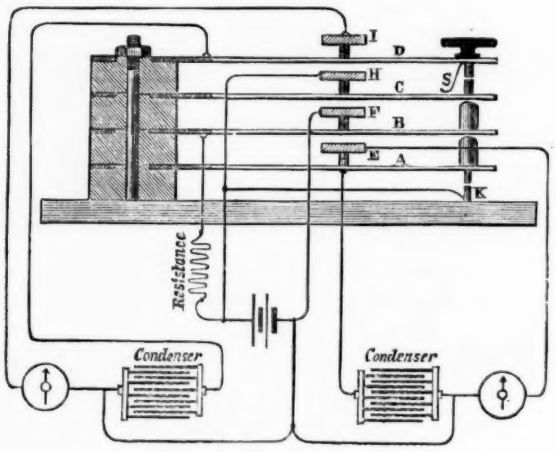


FIG. 2.

On pressing the key, D separates from I, breaking connection between the condenser and galvanometer for obtaining the difference of potential between the poles of the short circuited battery. The upper arm, D, coming in contact with C, connects the battery and condenser, which receives a charge, but this circuit is at once broken by the separation of C from H. C, descending, comes in contact with the hard rubber button on B, and depressing it, opens the battery circuit through the known resistance. The lower arm, A, is next engaged, and the circuit between the galvanometer and condenser for measuring electromotive force is broken by A leaving the cross-bar, E; the condenser and battery are then connected through K. As the key returns to its normal position, the condenser is discharged through its galvanometer, the resistance circuit again closed, the other condenser once more momentarily connected with the shunted battery, and finally discharged through its galvanometer. The whole operation is completed in a small fraction of a second. Both galvanometers employed by me are Thomson's reflectors of about 6,000 ohms resistance, and are placed 8 or 10 feet apart. The condenser battery and key are usually on the table in front of one of the galvanometers. Two observers are, of course, required. The galvanometers are usually so adjusted that one volt gives 200 or 300 divisions on the scale; this renders the computations much simpler. It would also be well to have the known external resistance some even number of ohms or tenths of an ohm.

A curious difficulty was encountered at first in the use of this key, when it was found that the condenser attached to the upper arm received variable charges for the same difference of potential. After some study and experimenting, the cause of these discrepancies was discovered. It has been explained that the condenser is thrown into circuit with the battery by the upper arm coming in contact with that below it. Now, as the arms are tolerably rigid, it happens that the interval of time between the contact of the two and the separation of the lower, C, from its cross-bar, H, is very short. Hence, as the condenser used was a large one—about $1\frac{1}{3}$ microfarads—there was seldom time for it to become fully charged. This failure was particularly noticeable with the small standards of electromotive force, the Clark and Plaster of Paris Daniell. A piece of watch spring soldered to the upper arm (as shown at S), so that contact between the two arms was made some time before the lower began to be pushed down, completely remedied the evil, and no further difficulty from the key has been encountered.

Mr. F. S. Pearson, a student in the laboratory, has devised a key necessitating the use of only one condenser, as shown in fig. 3. Its action is as follows:—The upper arm, B, descending meets the spring attached to the insulated platinum rod at S, which connects the condenser and shunted battery through

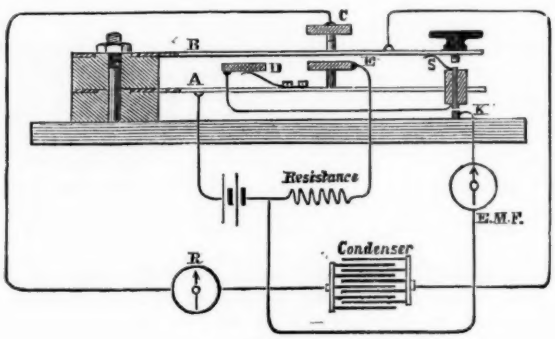


FIG. 3.

the cross-bar and spring at D. The spring at S merely serves to obviate the time difficulty mentioned in connection with my key. The condenser now becomes partly charged, and on the battery circuit through the known external resistance being broken at E by the descent of A, the condenser takes its full charge. As the lower arm, A, descends still further, connection between the battery and condenser is broken at the spring, D, and on connection being made between K and B, through the pin, S, the condenser is discharged through the galvanometer E.M.F. On the return of the arms, connection between the condenser and battery is first established, the condenser taking its full charge; but immediately the resistance circuit is established at E, and the charge of the condenser falls accordingly; connection at S is then broken, and finally the condenser is discharged through the galvanometer, R, from whose deflections the resistance of the battery is calculated.

I append a set of observations with each of two different cells, the Grove and the Orne (bichromate). The known external resistance was in each case ·714 ohm. The first column gives the times from the

instant of closing resistance circuit, the second and third the deflections of the galvanometer E.M.F., and the volts corresponding to those deflections. The fourth and fifth columns give the deflections and corresponding difference of potential for the other galvanometer. The sixth column gives the deduced internal resistance of the battery for the instant of observation :—

SMALL GROVE CELL.

Time.	E		E′		R
	Divisions.	Volts.	Divisions.	Volts.	Ohms.
h. m.					
0 0	360	1·80			
0 1	360	1·80			
0 2	...	...	440	1·47	
0 3	370	1·85	422	1·41	·223
0 4	370	1·85	423	1·41	·223
0 7	371	1·86	423	1·41	·228
0 10	377	1·88	423	1·41	·238
0 14	376	1·88	419	1·40	·245
0 17	380	1·90	424	1·41	·248
0 21	380	1·90	424	1·41	·248
0 24	379	1·89	426	1·42	·246
0 27	379	1·89	424	1·41	·243
0 32	378	1·89	423	1·41	·243
0 37	378	1·89	424	1·41	·243
0 41	376	1·88	423	1·41	·238
0 45	376	1·88	422	1·41	·238
2 5	368	1·84	407	1·36	·252
0 35	366	1·83	398	1·33	·261
3 5	365	1·82	397	1·32	·270
0 45	362	1·81	388	1·29	·288
4 45	360	1·80	369	1·23	·331
5 15	358	1·79	348	1·16	·388
21 30	280	1·40	124	·41	1·72
45 0	22	·11	4	·013	5·23

ORNE CELL.

Time.	E		E′		R
	Divisions.	Volts.	Divisions.	Volts.	Ohms.
m.					
0	357	2·00	450	·985	·74
1	325	1·82	320	·700	1·14
2	316	1·77	287	·628	1·30
3	314	1·76	259	·567	1·51
4	309	1·73	215	·471	1·91
5	307	1·72	209	·458	1·98
6	315	1·76	155	·339	3·00
7	316	1·77	146	·320	3·23
8	317	1·77	128	·280	3·80
9	317	1·77	113	·247	4·41
10	318	1·78	102	·223	4·94
11	320	1·79	101	·211	5·35
18	320	1·79	81	·177	6·51
24	314	1·76	66	·146	7·90
35	312	1·75	59	·129	8·98
43	315	1·76	54	·118	9·94
52	315	1·76	47	·103	11·49
Clarke	360		665		

The above are specimen observations. In general I may say that every cell has its own peculiarities, from the shape of whose curves for E.M.F. and R the cell may usually be recognised. Thus, the curves of the ordinary bichromate cell show at first a rapid, then a gradual falling off, of E.M.F. ; and at first a marked decrease, then a gradual increase, in R. The Leclanché cell resembles the bichromate as far as E.M.F. is concerned, but R in this cell remains nearly constant.

How it Works.—Scene : Lady and gentleman examining telephonic apparatus at the Electrical Exhibition. He : Do you know, dearest, how this works? She : I've no idea. He : It is simplicity itself ; you hold the apparatus with one hand whilst you speak with the other ! ! !

A BATTERY TEST.

A CORRESPONDENT of the Boston *Herald* says :—"In the Sunday issue of your paper of July 5th there appeared a notice of an interesting electrical test which was being made in this city, to prove whether or not the Kauffer-Goldner electric battery was able to light a circuit of incandescent lamps long enough to be practical for the ordinary purposes to which electric lights may be put. The experiment was made under my own supervision, and was so arranged as to preclude the possibility of any interference on the part of interested parties. The test is now at an end, and the battery has far exceeded the expectations of conservative observers. On Tuesday, July 7th, nine cells of this battery were closed in circuit with two 8-candle-power incandescent lamps, and so connected with an automatic clockwork that the current was closed for five minutes and 38 seconds, and opened for six minutes. The whole battery and clockwork was then enclosed in a suitable case and sealed with wax seals ; also every point in the conductors which could possibly be tampered with was fastened with a wax seal. The whole apparatus was so arranged that it was utterly impossible either to add anything to it or take anything away, or introduce any other electrical current in the circuit. The battery ran in this way, being automatically shut off and on from the lamp circuit from noon of July 7th till 10 o'clock a.m., July 20th. During this period of 310 hours, the circuit had been closed and the lights burning for 151 hours. At 10 o'clock a.m., July 20th, the battery was unsealed and examined, and found to be partly exhausted. The inner porous cups were then washed out and replaced, and at 11 o'clock a.m. on the same day the battery was again sealed up and the circuit closed, this time not off and on, but continuously. The lights in this way burned with unabated brilliancy. At 5 p.m. on the following day the circuit was broken, the lights having been burning continuously for 30 hours, in addition to the 151 hours already accomplished. At 9 a.m. on the next day (July 22nd) the circuit was again closed until 5 p.m., the lights burning brightly all the while. On the next day (Thursday) the circuit was again closed from 9 a.m. till 5 p.m. On Friday, July 24th, the circuit was closed at 9 a.m., but was opened at 2 p.m., at which time the incandescent lamps had begun to burn low, showing that the battery was exhausted. Upon opening the battery it was found that the solution had been pretty well used up. The zincs were bright and clean, and had lost about one-seventh of their weight. Between 12 m. on July 7th and 2 p.m. on July 24th, or during 408 hours, this battery of nine cells had lighted two 8-candle-power incandescent lamps for 202 hours, or about half the time. So far as it is known, this has never before been accomplished. In fact, there is no account of any battery that has ever continued to light an incandescent lamp for one-sixth of that time, and yet several gentlemen interested in such matters have this last week made statements to the effect that batteries had been or could be readily devised that would favourably compare with the test above described. If such results have heretofore been obtained they are certainly unknown to the writer and to the majority of electrical people. It is believed that it would be very interesting to the public if parties who have ever made a battery of nine cells that would light two 8-candle-power incandescent lamps for 200 or 100 or even 50 hours without renewing the solution would come forward and give an accurate and detailed account of their experiment."

Gas Consumption in "Otto" Engines.—Can any of our readers give us their personal experiences respecting the amount of gas consumed per hour by a small "Otto" engine of, say, 1 H.P. nominal, when giving 1 brake horse-power? Those of a larger growth consume about 30 cubic feet per brake horse-power per hour, and the small engines admittedly require considerably more.

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OBITUARY.

WE greatly regret to announce the death, at the early age of forty-one years, of Mr. Frederick Aldridge Ormiston, which occurred quite recently. Mr. Ormiston was well known amongst a large circle as a most able electrician and engineer. He commenced his career in the service of the Thames Iron Works Company, and thence entered the Engineer-in-Chief's Office of the Postal Telegraph Department, where for some time he was engaged in technical work of a high-class character. On the formation of the Brazilian Cable Company, Mr. Ormiston was offered the position, at a high salary, of engineer, which he accepted; in his official capacity he carried out the work of completing the cable, but after several months service he was prostrated by fever, from the effects of which he never entirely recovered, and had in consequence to resign his position. Mr. Ormiston next acted for a considerable time as superintendent of the instrument department of the India Rubber, Gutta Percha, and Telegraph Works Company, at Silvertown, and subsequently became engineer to the British Electric Light Company. Afterwards, in consequence of his extensive knowledge of the subject, he was employed from time to time by the Postal Telegraph Department to inspect the manufacture of telegraph cable, &c.; indeed he had been engaged upon such work within a very short time of his decease. Mr. Ormiston leaves a wife, but no family, to mourn his loss.

AWARDS AT EXHIBITIONS.

PERHAPS the most difficult task in life is to give satisfaction to everybody; on the other hand, it is most easy to displease, even unwittingly. We fancy that the distribution of medals at the Inventions Exhibition will be the innocent cause of more rancour than good feeling amongst the general body of exhibitors. This, however, should not be, for the value to be attached to such awards is more imaginary than real.

What, asks the *Electrical Engineer*, is the value of a gold or other medal, or any other honour, awarded by the jury at the International Exhibitions at South Kensington? The recipients of an award will envy those who have received a higher award, and maintain that the jurors ought to have decided differently; the scientific mind will laugh to scorn the idea of any scientific value, while the business man knows that the award has a real money value and brings grist to the mill. The manufacturers that have not received an award may say that their productions are quite equal to those of the successful ones—and this statement may be true as a fact—but the truth can never be brought home to the public. The cynic will say that medals, like kissing, go pretty much by favour, and while we should be inclined very much to agree with him, we are bound to say that usually gold medals do, in reality, gravitate to those who deserve them, the unfortunate part of the business being that others who deserve them just as much do not get them. Gold medals are limited in number; and while two hundred firms may deserve them, two hundred cannot receive them if there are but one hundred for distribution. It may be taken for granted, then, that while a gold medal indicates the reputation of a firm, the lack of a gold medal does not necessarily indicate an inferior reputation. The public does not understand this, and never will understand it; but so much the worse for the public, and so much the better for those who get the gold medals.

The remarks of our contemporary are very much to the point, but we would desire to add still further thereto. If the "Inventions" were an ordinary exhibition the basis of selection would, we suppose, be perfection of design or of workmanship, but when "invention" is the object to be rewarded, there is room for the application of various gauges as to what is a meritorious invention. Is it one that shows great ingenuity on the part of the inventor, and nothing more, or is it one that calls for recognition because of the patience with which the inventor has perfected an article or process of great public utility? It is to us obvious that the latter is the proper test of a meritorious invention, and yet we cannot see that the jurors have been guided by that principle. They seem, in fact, to have been groping for some basis to work on; and while most of their awards will meet with approval, there are some that certainly invite criticism.

The method of selecting the jurors appears to us open to grave objection. A form is sent round to each exhibitor asking him to nominate certain gentlemen to act on the jury. It is more than probable that no return is made by a large number of the exhibitors, as they have no predilection in the matter and prefer to leave it to the authorities to decide. If, then, a relatively small knot of exhibitors lay their heads together to nominate certain jurors, it may be taken for granted they will get their way, and may introduce names biassed in their favour. A much better plan would be for the Commissioners to nominate a jury of disinterested gentlemen, and to allow a power of veto to the exhibitors, as they would be more likely to give their opinion on a list presented to them than to take the trouble to make out a list themselves.

The majority of the gold medals call for no comment, but when we come to the silver medals the process of selection seems more invidious. It is very difficult to see why certain names should be selected as being more worthy than some of those in the "bronze" class. Coming to the bronze medals, we find two names which we should have expected to see at least amongst the silver. The one is the Anglo-American Brush Company, whose Victoria machine comes certainly under the designation of an invention of great public utility. We suppose there is no machine so generally admitted to be an excellent dynamo as this, and it is without doubt the outcome of patient inventive skill. Then, again, why are Paterson and Cooper left out in the cold? Their exhibits certainly are as varied and attractive as any, and the Phœnix dynamo we know to be a machine which has won its way to the front rank amongst dynamo machines. There are evident signs that a good deal of the work of the jury was very hurriedly done, and, in future, we think care should be taken that all gentleman are excluded who are inventors themselves, and are associated more or less with firms bringing out their inventions; and who may have antipathies or predilections which perhaps unwittingly bias their judgment.

ELECTRIC LIGHTING AT THE INVENTIONS EXHIBITION.

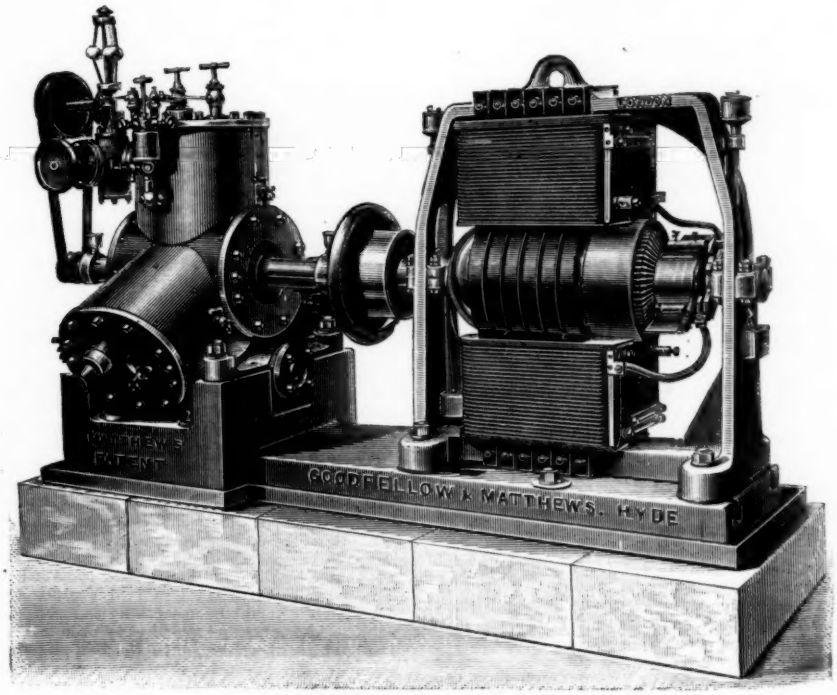
THAT the electric lighting of the Health Exhibition last year showed a distinct advance, as compared with that of the Fisheries in the previous year, was pretty generally admitted, and it will quite as readily be conceded, we think, that the result this year, as compared with last, displays a development and a number of improvements far exceeding that achieved in the interval between the first and the second of this series of exhibitions. In the engine shed, and throughout the buildings, there is evidence of a more systematic and careful carrying out of detail, and the adaptation of means to an end. This has gradually become the more apparent as the system of lighting slowly reached the completion which now characterises this department of the exhibition. There are some important additions this year to the electric light systems, and also to the number of engines specially designed for driving electrical machinery. Among the former, that of the Thomson-Houston Company, represented in this country by Messrs. Laing, Wharton and Down, is attracting, perhaps, the most attention, from the fact that this is the first public exhibition on this side of the Atlantic of a system of lighting which in the United States seems to have made the most rapid progress of all. We fully described the system in our issues of November 15th and 22nd, 1884, but the following particulars of what has been done by the American Company may be interesting. They are supplied to us by an official of the company, Mr. Whitney Munro, of Boston.

"The Thomson-Houston system was first practically brought to the notice of the public about three years ago, at a time when the Brush, Weston, Edison, and other systems had been extensively introduced in nearly all the larger cities, and the business of electric lighting had been brought down to a strictly commercial basis. We had then passed through the experimental stage, when electric lights were viewed as a novelty, and had weathered the inflation period which followed, and during which hundreds of thousands of dollars were swamped in 'wild cat' electric lighting companies, and had at last reached a point where the only hope of success lay in the furnishing of an economical and efficient system of lighting. It was at this period that the Thomson-Houston Company entered the field, and by the superior merits of its system soon gained a foot-hold which has resulted in its establishing a business second to none in this country. As an evidence of the popular demand for electric lighting in this country, it may be stated that the Thomson-Houston system alone has been adopted by over sixty local lighting companies in as many different cities, all of which are paying expenses, and the majority are declaring dividends at regular intervals of from 3 to 16 per cent., and in some cases as high as 20 per cent.; this too in the face of sharp business competition. Such is the progress made by the youngest company in the field, besides which, it must be borne in mind that the Brush, Edison, Weston, Fuller and other electric lighting companies are energetically pushing their business, so that there is scarcely a city in the United States to-day which has not adopted to a greater or less extent electric lights. In our larger cities the streets are nearly as light by night as by day, and still the demand for electric lights is steadily on the increase, and large additions are continually being made to the plants already installed. In conversation with an English gentleman recently, the latter remarked that his visit to the United States was for the purpose of enquiring thoroughly into the details of the various American systems of electric lighting,

and that he had left home prepared to see some very well lighted cities, but what he had observed since his arrival here had greatly surpassed his expectations, and that he was pleased and surprised at the generous manner in which electric lights had been adopted in the cities which he had visited. The outlook for electric lighting interests was never more encouraging than at the present time, and the indications are that all the leading companies here will do a large business during the next year."

This exhibit is also interesting from the fact that two of the machines are driven by the second Armington and Sims engine made in this country; the first being the one now at the exhibition at the stand of the makers, Messrs. Greenwood and Batley, of Leeds. This engine has been used very largely in connection with electric lighting in the States, and will probably be a favourite here also.

The installation of the Thomson-Houston system at the present Exhibition consists of one 45-light machine running 42 arc lamps



COMBINED ENGINE AND DYNAMO.

of 2,000 C.P., 54 incandescents, and a 1 H.P. motor, all in series, the motor being shown at work at the stand driving a small dynamo to supply current to four model arc lamps in series, taking 2 ampères and 60 volts each, which are hung on the stall. The Armington and Sims engine in the electric lighting shed drives two other machines, one an 18-lighter, each lamp of 1,200 C.P., viz., 50 volts and 6·2 ampères, and the other a 6-lighter, 4,000 C.P. The area lighted is the east arcade and east gallery.

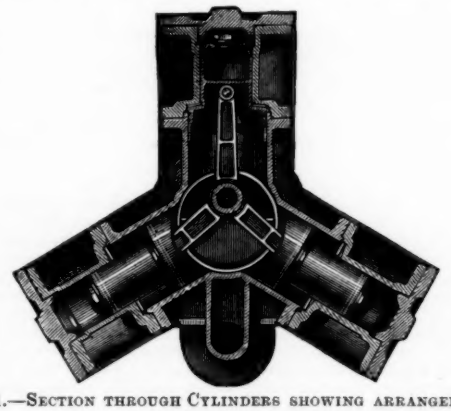


FIG. 1.—SECTION THROUGH CYLINDERS SHOWING ARRANGEMENT OF PISTONS, &c.

The lighting of the grounds by incandescent electric lamps in place of the small coloured oil lamps previously used is one of the most noticeable of the improvements that have been effected, and the way in which the work necessary for this change was carried out by Messrs. Siemens in the short space of 11 weeks has been the theme of considerable comment and satisfaction. During that brief period special dynamos were made of larger dimensions and power than were ever before constructed by the firm, and during the same short period special engines of a new construction were supplied by the firm of Goodfellow & Matthews, everything being practically completed in time for the opening night of the Exhibition. There are three dynamos and three engines constructed and erected for this work, only two of which are required to be run, the third being held in reserve. The dynamos are described as B 3 self-regulating machines, giving a current of 450 ampères and 250 volts at 300 revolutions per minute. The machines are 9 feet high, 8 feet long and 4 feet 6 inches wide, and their weight is from 11 to 13 tons each. The armature of each weighs about 3 tons, is 2 feet 5 inches in diameter and over 3 in length. The four series coils, which are coupled in parallel, are wound with copper wire ·4 inch in diameter, and the shunt coils, which are coupled in series, are wound with No. 9 S.W.G., flat strips being used instead of wire for the armature. Each dynamo is coupled direct to a Goodfellow and Matthews compound "Triplex" tandem engine fixed on the same bed-plate. About 160 actual horse-power is required, and the engine is calculated to indicate upwards of 200 horse-power with a boiler pressure of 120 lbs. per square inch and a speed of 320 revolutions per minute. The cylinders are 9 inches and 18 inches diameter, 10½ inches stroke; the mean piston speed is therefore 560 feet per minute.

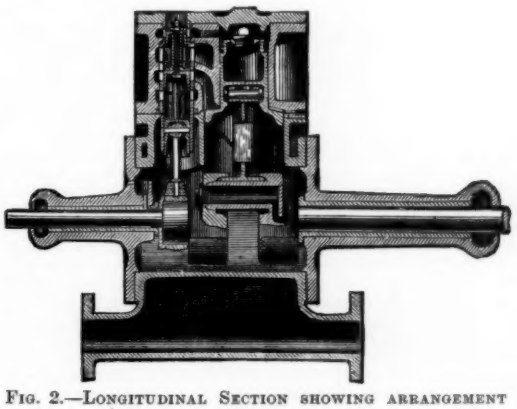


FIG. 2.—LONGITUDINAL SECTION SHOWING ARRANGEMENT OF PISTONS, VALVES, PORTS, &c.

The following are a few of the leading dimensions:—Valves: 5 inches diameter, 4 inches travel, 1⅜ inches lap, ⅛ inch lead. Cross-head pin: 3½ inches diameter, 6 inches long. Crank pin: 5½ inches diameter, 9 inches long. Crank shaft: 5 inches diameter, length of bearing on driving side 24 inches, length of bearing on eccentric

side 16 inches. Steam branch: 3¼ inches diameter. Exhaust branch: 5 inches diameter.

The makers of these engines inform us that since the Exhibition opened they have received a gratifying number of orders for similar ones, and have every reason to believe that they will be

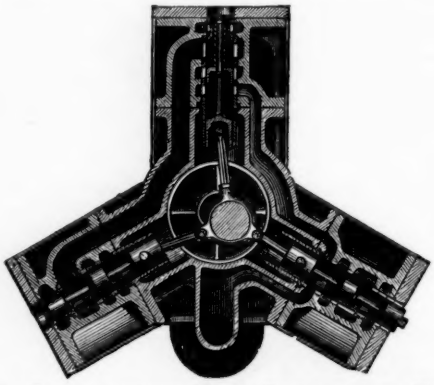


FIG. 3.—SECTION THROUGH VALUE CHESTS SHOWING VALVES, ECCENTRICS, AND RODS.

very successful. The engine is all that can be desired in good workmanship, material, and general design and finish. It is perfectly compact and easy to get at, and has been arranged with special attention to having large bearing surfaces and strong working parts throughout.

THE TELEGRAPH CONFERENCE.

THE following particulars as to the antecedents and *raison d'etre* of this conference, now proceeding at Berlin, are given by the Berlin correspondent of the *Times*:—

The International Telegraph Conference, which met here last Monday, is the continuation of a movement initiated more than a quarter of a century ago. The first meeting of the kind was held at Brussels, in 1858, at the invitation of the Belgian Government, and paved the way for the General Telegraph Union, which at first comprised the States of Europe only. Paris had the honour of welcoming the next conference of the kind in 1865, then Vienna in 1868, Rome in 1872, St. Petersburg in 1873, and London in 1879; and each of these meetings marked a distinct stage in the administrative development of an institution which has already done so much for the human race. At the Vienna Conference, the Union was joined by Russia (Asiatic) and India, while at Rome the cable companies were represented for the first time. The London meeting, six years ago, was negatively marked by the failure of the German Postmaster-General to introduce a reduced and uniform word-tariff for all Europe, but his Excellency Dr. von Stephan—who has justly been called the Rowland Hill of Germany—is a man who, once having put his hand to the plough, has never yet been known to take it away without in the long run guiding it to the end of the furrow; and he has now, therefore, returned to the attack with his schemes of fiscal and administrative reform. Under the present system of telegraph tariff obtaining in Europe, as I have already had occasion to point out, many glaring inconsistencies and inequalities exist. For instance, a telegram from Rome to the French frontier costs 5c. per word, and from the frontier to Paris 5c. more; but a telegram from Rome to Paris costs 18c. or 20c., instead of 10c. As a result of this, the principal Italian newspapers have agents at Modane, a French town near the frontier, who receive despatches from Paris, then cross the adjacent frontier and telegraph them on to Rome. Again, a telegram of 20 words from Berlin to London costs 4m. 40pf.; to Paris, 3m. 20pf.; to Rome 3m. 75pf.; to St. Petersburgh, 5m. 40pf.; and to Madrid, 5m.; although mere "electrical distance" is not exactly an element of proportional expense, and although also an international telegram, according to Dr. von Stephan, entails less expenditure in the main than an internal one. Similarly a message of 20 words from Rome to Paris costs 3 lire 80c.; to Vienna, 5 lire; to Berlin, 6 lire; to Madrid, 9 lire 60c.; and to the "scape-goat of all countries"—England—as much even as 10 lire 40c. It was, then, with the view of remedying anomalies like these, and rendering the advantages of the electric telegraph much more attainable than they are at present, of making telegraphy, in fact, the rival of the penny post, that Dr. von Stephan has submitted to the conference certain proposals, which are formulated thus:—

INTERNATIONAL TELEGRAPH TARIFF (EUROPEAN NET).

I. Uniform rate.—The tariff of international telegrams in Europe consists of a fixed rate (Grundtaxé) of 50 centimes, and a charge of 20 centimes per word.

II. Supplementary charge.—For telegrams forwarded by submarine cables a supplementary charge—which must not, however, exceed 10 centimes per word—may be made.

III. Distribution (of costs).—Each administration (or Government) will receive (and keep) all charges whatsoever for telegrams despatched within its territory, paying out of its income any subsequent claims of dues for transit by land or sea.

IV. Transit dues.—These are fixed—

(*a*) For land telegrams—(1) for Belgium, Bosnia and Herzegovina, Bulgaria, Denmark, Greece, Luxemburg, Montenegro, Norway, the Netherlands, Portugal, Roumania, Servia, and Switzerland, at 2 centimes per word; (2) for Germany, Austria-Hungary, Spain, France, Great Britain, Italy, Russia, Sweden, and Turkey, at 4 centimes per word. For certain transit lines this latter charge can be reduced to 2 centimes by the Government of transit.

(*b*) For sea-cable telegrams—(1) for distances up to 300 nautical miles, at 5 centimes per word; (2) for greater distances, at 10 centimes per word. In no case may the dues for transit, by land or sea, exceed those at present in force.

V. Conterminous countries.—By common agreement between two conterminous countries, the charge per word may be reduced from 20 centimes to 10 centimes.

The praiseworthy principle underlying the above German proposal is that "international telegraph dues ought not to be higher than the sum of the internal charges of the individual countries concerned," and Dr. von Stephan has enumerated a long list of advantages—among them the gradual abolition of the troublesome clearance-house system—that would accrue from the general recognition of this theory. But, unfortunately, this theory of his, for the present at least, is viewed with small favour by several Governments which are mainly guided by an eye to the state of their own exchequer, as well as to the vested interests of the private cable companies under their protection. The German proposal has now been under the consideration of the Conference and its committees for a whole week; and the spirit of conciliation and compromise manifested by all the delegates has been fostered by dinners and luncheons, beer parties, prospective entertainments, and all sorts of hospitable courtesies; but the British shareholder is a dogged personage, and not over prone to subordinate his love of dividends to his general desire to keep pace with the beneficent movements of the time.

Among all the delegates there is every disposition to discuss in a very fair and matter-of fact spirit—untinged with the slightest trace of international political feeling—Dr. von Stephan's important scheme of reform; but when thoroughly investigated it assumes such serious proportions that it is not at all likely to be adopted in anything like its entirety. As far, indeed, as Germany herself is concerned, it would suit her uncommonly well, seeing that, situated as she is in the centre of Europe, she would have to make comparatively small out-payments. But countries, on the other hand, like Denmark, Sweden, Turkey, and England, being at the extreme limits of Europe, would be at a serious disadvantage by the adoption of the proposed change. States like France and Italy, too, would also suffer considerably, as their transit rates would be materially reduced; while the submarine cables—whose tariffs have already been assimilated with those of the land-lines—would, if the German proposal were adopted, lose from 50 to 70 per cent. of the revenue which they now derive from European messages. It is only natural that Germany should not appreciate to their full extent the objections above referred to, as the losses incurred by the companies might be imdemnified in different ways, in accordance with the economic policy pursued by her in these matters, either by the buying up of the cables, by subvention, or by guaranteeing the revenues hitherto obtained. But it is very doubtful whether all or any of the other European Governments would be prepared to entertain the same views. And as statistics are said to show that the working of the Government land lines results in a loss to nearly all of them, even at the rates at present in force, the acceptance of the German proposals, as it is calculated, would increase this deficit to such an enormous extent that the exchequers of the various States would be burdened more than they could be expected to bear, even without their granting any kind of idemnification to the cable companies. This, at least, is the light in which the German scheme is viewed by those who are mainly interested in opposing it. For the rest, the Conference will have to deal with a proposal on the part of England for better regulating the use of code messages; but this question has not yet been sufficiently ventilated here for much to be said about it at the present moment.

On Thursday, the 13th, there was a long plenary sitting of the Conference, when the Austro-German proposals for a reduced and uniform European tariff were submitted to a lively discussion. These proposals were respectively opposed by England and Russia—by the former for the more especial reason that their acceptance would seriously interfere with the vested interests of the private cable companies, and by the latter on the ground that great detriment would thereby accrue to the Imperial revenue. A considerable majority of the delegates were in favour of the proposed new tariff system. No positive result was, however, arrived at, the question being again referred to the committee for further consideration.

On Friday, the 15th, the delegates responded to the invitation of the German Postmaster-General to inspect the post and telegraph offices, as well as the Imperial printing-office. In the evening Dr. von Stephan and the delegates were entertained at a banquet in the Kaiserhof by Mr. John Pender, M.P., on behalf of several private English companies, when Mr. Pender toasted "Telegraphy throughout the world," in connection with the

name of his chief guest. Herr von Stephan, in responding, paid a high compliment to Mr. Pender, Sir James Anderson, and other Englishmen present as the champions of British enterprise in the field of telegraphy. As the general result of the day's discussions in committee, the *Times* correspondent heard that an offer is likely to be made on the part of the English cable companies, by way of testifying their theoretical approval of Germany's proposals, to reduce the tariff on Indian telegrams by sixpence per word, on Australian telegrams by half-a-crown per word, as well as to reduce the charge for Press messages to both these destinations by one-fourth. It was not certain how this advance would be received.

On Saturday, at a meeting of the Tariff Committee of the Conference, a long discussion resulted in the decision of something like a majority of the members against the German proposals for reduced and uniform charges throughout Europe. It was thought possible that some sort of compromise between the Governments and the cable companies might still be effected.

On Sunday morning Dr. von Stephan, Postmaster-General, held a reception of the delegates and others connected with the Conference, who were afterwards entertained to a buffet luncheon by their host.

On Monday there was another meeting of the Tariff Committee, which, after some considerable discussion, rejected a proposal on the part of Belgium to assimilate the European and extra-European *maximum* number of chargeable letters in one word which is at present 15 and 10 respectively. The Belgian motion aimed at extending the *maximum* number of chargeable letters in single words of extra-European messages to 15, but here again the interests of the cable companies were vigorously defended, and the proposal was thrown out.

In the evening the delegates and others were entertained at another banquet in the Zoological Gardens by the United German Telegraph Company, which is mainly interested in the lines from Berlin to England and America, *vid* Emden. M. Nielsen, the Norwegian representative, as being the *doyen* of his colleagues, proposed in French the health of the Emperor. On behalf of the United German Telegraph Company, Dr. Lassar then toasted the guests of the evening. The compliment was most warmly acknowledged by Signor d'Amico, Director-General of the Italian telegraphs, and then Mr. John Pender, M.P., in an English speech, spiced with a dash of international politics and with an ardent eulogy of the merits of the German Emperor and his great Chancellor, asked for a brimming bumper—*more Anglico*—to the health of Dr. von Stephan, Postmaster-General of the Empire. His Excellence, speaking in fluent French, made a most able and witty reply, of which perhaps the most applauded portion was his expression of the hope that some of the praise which had been lavished on his person might be extended to the proposals that he had placed before the Conference. Referring to Mr. Pender's eulogy of Prince Bismarck, he begged leave to assure his hearers that the Chancellor was most deeply interested in the work of the Conference, and that he himself was in daily correspondence on the subject with the Prince. But with all that, says the *Times* correspondent, it is now pretty certain that the German proposals will not be accepted in anything like their entirety.

The Tariff Committee meetings of Tuesday and Wednesday resulted in a recognition of the general principle that what is called the "Grundtaxe," or fixed preliminary charge, on every telegram before the cost of its transmission is assessed according to the number of words, should be abolished or simplified, as well as that terminal dues should be rendered uniform. These decisions only form the basis of further discussion by the plenary conference itself, but they point to the existence of a spirit of conciliation and compromise among the delegates which will probably enable the German Postmaster-General not to go wholly empty-handed away, though, according to the *Times*, it was still regarded as certain that he would not succeed in achieving the acceptance of his proposals in their entirety. His scheme of uniform telegraph dues for all Europe was rejected by a majority of nine to seven. A new delegate has arrived in the person of Iskandar Bey Fehmy, Egyptian Minister of Railways. Mr. John Pender has left to visit Count Münster, at the latter's estate in Hanover.

According to the *Colonies and India*, Mr. Henniker Heaton, the representative of Tasmania, has sent a written request to the British delegates to call a meeting of British, Indian, and Colonial representatives, in order to discuss the proposal to reduce the present high tariff, and to take joint action in the matter. The proposal has been favourably received, and only awaits the arrival of the Cape and Victorian members to be acted upon.

ELECTRICITY IN THE ROYAL NAVY.

In an article upon the annual inspection of the dockyards, &c., at Portsmouth by the Lords of the Admiralty this week, the *Times* comments upon the remarkable progress made during the past 12 months in the general adoption of electric light apparatus in nearly all sorts and conditions of men-of-war, so far as search lights are concerned. The machines selected are also suitable for the internal lighting of the ships by the incandescent system, and there can be little doubt that the superior comfort and even the necessity of electric lighting will be soon universally recognised in a practical manner. There have been complete installations on board the *Indian* and other troopships, the torpedo ram, *Polyphemus*, and the *Colossus*, and there are to be similar installations in the *Collingwood*, *Edinburgh*, and *Imperieuse*. At the beginning of the year a carefully-conducted trial of a week's duration of the "compound-wound" dynamos, known as the Victoria, was carried out in the *Colossus*, which fully demonstrated that electric lighting on board ship, in addition to many other advantages over oil and candles, also possesses in a striking degree that of economy. These experiments, which were continued uninterruptedly day and night, were based on the actual requirements of a ship at sea, and doubtless hastened the decision to fit dynamos in all our fighting vessels. The cost of systematic trials of this kind has to be borne by the Admiralty. But the trials have already borne good fruit for the Navy and country generally, and will amply repay the nation in the long run by reducing the expense of the lighting apparatus and the expenditure of fuel. It is also worth alluding to the other numerous and important electric appliances which have found a home on board our vessels of war. The ships are navigated from armoured towers or other protected positions, where are placed every requisite for fighting or navigating purposes. The commanding officer must be able to communicate readily by voice pipes with the battery or turrets, with the engine rooms, magazines, and various other parts of the ship. But it has been thought expedient in some ships to supplement the ordinary means of communication by telephones, and different systems are under trial. The experiments must, however, extend over a considerable period and under different conditions before it can be absolutely decided which is the best method to adopt, or whether, indeed, telephones can be relied upon in such ships in cases of emergency. But it is also necessary that the officer shall not only be in a position to convey his orders from the tower to the engine room and fighting stations, but that he shall also be certain that his instructions are understood and obeyed. This is accomplished by a system of electric telegraphs and revolution indicators. Electric steering telegraphs and tiller indicators are also necessary parts of a perfect equipment, and in order to enable the commanding officer to have complete control of the guns and torpodoes, so that he may be able to discharge all or any of them as required, electric firing currents are fitted, by means of which he has only to press a key, and so complete the circuit, to fire the guns or eject the torpedoes at will. In turret ships it is, furthermore, important that the guns should not be fired when directed, as they must be while the turret is being rotated, towards any part of the superstructure, or when they are depressed in some positions towards the deck. To prevent accidents arising from the non-observance in the heat of action of the precautions against accidents, automatic electrical arrangements have been devised, by which it is simply impossible for the guns to be fired when at the "dead points." Additional electric combinations are necessary to enable the guns to be fired from the turrets instead of from the conning tower. These tend to further complicate matters on board, and without enumerating in detail other costly electric fittings of a man-of-war, we have only to add that auxiliary conning stations are provided in case of disaster occurring to the main positions, to show how absurd and misleading it is to compare, as is sometimes done, the cost of constructing an armourclad with that of a merchant ship.

NOTES.

Electric Lighting Installations.—In the interesting description of the installation at Ashton Court, the residence of Sir Greville Smyth, it will be noticed that the suggestion contained in the letter of Sir David Salomons, published in our last issue, had already been taken into consideration by Mr. Sidney Sharp, under whose direction the lighting at Ashton Court was carried out.

Electric Lighting in the Navy.—Arrangements have been made to light the new barbette ship, the *Camperdown*, in course of construction at Portsmouth, by electricity throughout, and the work, which will be carried out by Messrs. Siemens, assisted by the dockyard staff, has been commenced.

The expediency of completely lighting the *Inflexible* by electricity is still under the consideration of the Lords of the Admiralty, whose experiences on board the *Colossus*, says the *Times*, must have removed any vestige of hesitation on their part as to the transcendent superiority of the latest system of illumination, as the *Colossus* is actually ready for sea with the exception of the trial of her guns. When, on their lordships going on board, the whole of her interior spaces were lighted by incandescent lamps the effect was so extremely brilliant that the visitors could not refrain from expressing their satisfaction.

Electric Lighting of the British Museum.—Amongst the notices of motion standing in the order book of the House of Commons for the next session is the following: "Mr. Coope—British Museum (lighting by electricity)—That, in the opinion of this House it is expedient to light the British Museum and the National Gallery without delay by means of electricity, and that the public be admitted to these great national collections on at least three weekday evenings in the week."

Theatre Lighting by Electricity.—Last Saturday night the Theatre Royal, Berlin, was for the first time illuminated by electricity, the experiment being attended with perfect success.

Lighting of an Ironclad,—The installation just completed on the Brazilian ironclad, *Aquidaban*, by Messrs. R. E. Crompton & Co., was subjected to a trial run on Thursday, and fulfilled expectations. Three Willans's engines are coupled direct with an equal number of Crompton's new type of dynamo, which each supply current for 180 Swan incandescent lamps. Two powerful search lights, each of 25,000 C.P., form an important part of the installation. We shall give further details of the lighting of this vessel next week.

The Electric Light on the Stage.—The sudden illumination of one of the rooms of the Russian Embassy at Paris, in the last act of the "Great Pink Pearl," at the Prince's Theatre, Piccadilly, causes a sensation every evening. The stolid attendant of military character who "speaks not ze Eengleesh," at the word of command, touches a switch near the door, and immediately the darkened room becomes illuminated with a brilliant but softened light from the various groups of incandescent lamps, which, of themselves, form a pleasing addition to the decorations. Most of our readers know that Mr. Berry is the electrician in charge of the electric lighting arrangements at this theatre.

Electric Lighting in New Zealand Mines.—In an article dealing with mining in the Wakatipu district, the *Otago Daily Times* states that, at Skippers, Mr. Fred. Evans, the progressive mine manager of the Phœnix, has nearly the whole plant of dynamo-electric apparatus upon the mine site, and so soon as circumstances will permit, the machinery will be put in motion, and electricity will be applied in a multitude of ways. There being a good water supply available, it is calculated that enough power will be generated by its aid to work the pumps, to keep the mine clear of water, to drive—at least, partly drive—the crushing machinery, to light the works with electricity, and to apply a current to the gold-saving apparatus. Trials made by Mr. Evans, with his new apparatus in an incomplete state, are said to justify most sanguine expectations of success.

Electric Advertisements.—Mr. Berry, the electrician to the Prince's Theatre, is responsible for the following method of advertising. The "plant" consists of a man, a stick, a silk pearl shaped balloon, with an incandescent light inside, a Morse key and an accumulator. By means of the key the man can illuminate or darken the balloon at will, to the great astonishment of the people around him, whose curiosity or thirst for knowledge is excited to an extent to gratify which seems beyond the power of the man at the end of the stick. At any rate, Berry's electric pearl is doing that for which it is designed, viz., calling attention to the "Great Pink Pearl" at the Prince's Theatre. The accumulator consists of four Faure-Sellon-Volckmar cells, lighting an eight volt "Star" lamp, both supplied by the Electric Apparatus Company, Limited.

Lighting of the Guildhall Library.—The *City Press* states that some dissatisfaction has been expressed at the present mode of lighting the Guildhall Library, and hopes are felt that the City Lands Committee will consider the advisability of illuminating the library with the electric light, after the overhauling which is about to take place.

More Electrical Schemes.—The *Financial News* states that Mr. Montgomery, of New York, who placed the Brush Electric Light enterprise in London, and is credited with having made $1,500,000 out of it, is here again with several new electric schemes.

A Comparison.—New York is said to be the best electrically lighted city in the United States, while Cleveland, Ohio, the home of Brush, is the poorest.

The Lighthouse Experiments.—The result of the recent experiments at the South Foreland lighthouses, in which the relative merits of oil, gas and electricity were tested, is, in the view of the committee which carried out the investigations, to establish the fact that "for the ordinary necessities of lighthouse illumination oil is the most suitable and economical illuminant, and that for salient headlands, important land falls, and places where a very powerful light is required, electricity offers the greatest advantages."

The Electric Light in a Coffee Palace.—The premises of Mr. John Pearce, 84 and 85, Farringdon Street, have been lighted for some weeks past by seven Clark-Bowman lamps, from one of Stanley and Davies AAA Gramme dynamos, driven by a six H.P. Otto gas-engine. The engine-power, which was put down for the purpose, is compactly arranged in the basement of the premises, and the installation is very effective. The contract has been carried out by Mr. C. R. Heap.

The Vibrations of an Electric Lighting Engine.—Sir Coutts Lindsay and Company, Limited., are proceeding against Mr. Charles Dixon Aria, of 139, New Bond Street, for perjury in swearing in an affidavit that a cellar belonging to him and adjoining one occupied by the company, was of a depth of 25 feet, and was injured by the vibration caused by an engine driven for electric lighting purposes in the company's cellar. It was asserted that Mr. Aria's cellar was only 7 feet in depth, and that no vibration could be detected therein. The case is under adjournment.

Electric Lighting in Manchester.—The Manchester and District Edison Electric Light Company is lighting the Manchester and Salford Bank, a large portion of Messrs. S. and J. Watts's warehouse, and several gentlemen's houses, and is carrying out other smaller installations at Manchester.

Telephonic Extension in the North.—In direct contrast to the prevailing apathy in some parts of the South of England is the readiness with which the telephone is taken up in the North. This week we publish the report of the Lancashire and Cheshire Telephonic Exchange Company, presented at the meeting of the shareholders of the company on Thursday last, and this shows a degree of successful enterprise unprecedented in the South. The map alluded to in the report shows the existing connections from Manchester to Liverpool, Stockport, Oldham, Rochdale, Bury, Burnley, Blackpool; the new lines in course of construction from Manchester to Staleybridge, to Rochdale and Littleborough; from Burnley to Todmorden; from Wigan to Chorley, Heapy, and Blackburn to Preston, Kirkham, and Blackpool; and from Waterloo (near Liverpool) to Southport; and proposed lines in various directions from Manchester to Bowdon, to Warrington, and to Todmorden; cross-lines from Ashton-under-Lyne to Oldham and Rochdale, from Oldham to Middleton and Bury, Bolton, Tyldesley, and Leigh; from Stockport to Macclesfield; from Liverpool to Chester, Runcorn, Northwich, and Middlewich; from Wigan to Ormskirk, and Southport; from Blackpool to Fleetwood; from Preston to Lancaster, and thence to Ulverstone, which is already in connection with Dalton and Barrow. The company had, at the end of June last, 3,142 subscribers, whilst there were 907 private rentals, an increase of 408 and 79 respectively for the twelve months.

The Telephone in Rome.—The Italian Minister of Public Works has consented to the formation of the "Società Romana Co-operativa dei Telefoni," which unites the two rival telephone companies hitherto existing in Rome.

Fire in a Telephone Exchange.—A fire, supposed to have been caused by contact between a telephone and an electric light wire, broke out on August 1st in the roof of the New England Telephone building, Lowell, Mass., disarranging the wires and causing a suspension of business. The loss was slight.

Telephonic Communication at Eastbourne.—At the last meeting of the Eastbourne Town Council it was decided to connect New and Old Eastbourne and the fire brigade stations and police stations by means of the telephone, the United Telephone Company undertaking to keep the same in good order. It is felt that telephonic communication between the two latter stations may prove of immense value, particularly in case of the outbreak of a serious fire, when every moment would be of importance in getting to the scene of the conflagration.

The Portsmouth Telephone Exchange.—The success of this exchange, which was established not long ago chiefly through the instrumentality of the local Chamber of Commerce, has not proved so great as was anticipated. The tradesmen of the town have not accorded the undertaking that support which it without doubt deserves, and have exhibited an extraordinary degree of cautiousness with regard to giving in their names as members. This cannot be because the terms are too high, because they will compare favourably with those charged in other parts of the country, whilst the West of England and South Wales Telephone Company, which has originated the enterprise, has offered no ordinary inducements to those who would join early. The Hon. Secretary of the Chamber of Commerce has just issued an appeal to the members of that important body to embrace without delay the advantages of intercommunication afforded by the telephone exchange. He points out that with such a scattered business community as is to be found in the Borough of Portsmouth, the usefulness of the exchange hardly needs demonstration; and the greater the number of subscribers, the greater the privileges secured by them. In order to give a fresh stimulus to the undertaking, arrangements have been made with Mr. Boughton, the manager of the New Theatre Royal, to have that place of amusement connected with several hotels and clubs so as to enable visitors and members to secure seats by means of the telephone; and it is also proposed to connect the County Court with the Exchange for the convenience of men of business. A call room at the Portsmouth Town Railway station will probably be established, and other schemes are in contemplation with the view of popularising the Exchange, which, it is hoped, will in the future secure a far larger measure of support than has been its share in the past.

Telephonic Con.—Why is Mr. Justice North like a diaphragm? [Replies not later than the termination of the Vacation.]

Wanted.—Telephones, free from infringement of the Bell and Edison patents. Would any one go so far as to say that "no 'Irish' need apply"?

Liabilities of Telephone Companies.—According to exchanges, the telephone companies in the States may be held liable for injuries to passengers by the fall of their wires in a public street. In a recent case, in which this was decided, the wires gave way in consequence of the weight of the ice produced by water thrown upon them by a city fire department whilst extinguishing a fire.

Mechanical Telephones.—Mr. Irish of Sunderland, whose electrical telephone we illustrate this week, has submitted for our inspection one of his mechanical telephones. He has manufactured these for several years past, and we have no reason to suppose that they are in any way inferior to that which has been, within the last three weeks, the subject of so much absurd praise in the advertising columns of the daily press. The diaphragm in the Sunderland instrument is of ferrotype metal; for short distances a mechanical tapping arrangement suffices to call attention, while for longer distances, the same may be employed to put in circuit a battery and bell.

The Telephone at the Manchester Chemical Club.—The Manchester Chemical Club celebrated its entrance into its new home at the Victoria Hotel on Tuesday night by a dinner. The club has been in existence for some two years, and the members now number about 120, some 50 attending the inauguration of the new and well-fitted rooms. Mr. I. Levinstein presided, and Mr. W. E. Heys explained telephonic apparatus, which, by the kindness of Mr. Moseley, had been put up for the entertainment of those present by Mr. J. Poole, electrician to the Lancashire and Cheshire Telephonic Exchange. One of the call-office appliances, of which Mr. Poole is joint inventor, was in operation, and the room was also connected with Bolton, Bury, Blackpool, Liverpool, and other places. Mr. W. T. Glover had sent samples of the different kinds of cables now in use, and a fragment of the first Atlantic cable.

Governmental Control of the Telegraph.—The *Telegrapher's Advocate* of New York points out that in America, with the advent of old age, the average first-class telegraphist is apt to be removed in favour of younger blood, or is retained on a low salary, and urges this as a reason why operators should assist in bringing about government control of the telegraph lines, in order that they may become entitled to pensions, like their brothers in England and other countries.

American Telegraph Troubles.—The property of the Bankers' and Merchants' Telegraph Company, regarding which there have been many disputes recently, was sold at auction on the 31st ult. to Edward S. Stokes, a bondholder and member of the reorganisation committee, for £500,000.

Telegraph Revenue.—The receipts on the telegraph service from April 1st to August 15th, 1885, amounted to £680,000 against £675,000 received from April 1st to August 16th, 1884.

Post Office Employés.—A correspondent, signing himself "X. Y. Z." writes as follows to the *Western Morning News* of Wednesday last:—"I read with much regret the death of Mr. H. Oxburgh, of the telegraph department, Plymouth, recorded in your issue of to-day. The deceased leaves a wife and three children. I think this is an opportune occasion to put the following question to the Postmaster-General: 'Ought not the Government, whose servant he was for eleven or twelve years, to render some assistance not only in this case, but in every case where the employé has worked in the service for over a certain number of years—say ten?' For the pension which an officer of the Post Office receives, if he live to the age of sixty, a deduction in his salary is no doubt made by the Department in some way. Then, if this be so, surely some grant, which I consider belongs to a deceased officer who has worked over ten years, should be paid to his widow or friends. In some Government departments this is done. Why not let the rule be applied to the Post Office, whose officers are not sufficiently paid to be able to put by a few shillings for a rainy day? In the generous hands of Mr. Macliver perhaps something might be done for poor widows of long-service Post Office employés."

"Wanted: Some Telegraph Cables."—This is the title of a leading article in last week's issue of the *Colonies and India*, which advocates the extension of telegraphic communication by cable in various parts of the world. Our contemporary considers a new cable to South Africa imperatively necessary, and proceeds to argue upon the lines of our leader, "Cables to the Cape," in the REVIEW of April 25th last. It also remarks that a second line to Australia is quite as necessary; while a third great desideratum is an improved service to the West Indies.

Cable Rates.—The committee of the Melbourne Chamber of Commerce has decided to request the Postmaster-General to endeavour to get the Governments of the various colcnies to co-operate with him in trying to induce the Eastern Extension Telegraph Company to lower the rate charged for telegrams between Australia and New Zealand.

The Cook's Strait Cable.—The Cook's Strait cable, which has been down 19 years, and has three wires, is believed to be broken.

A Reverse of Fortune.—A story comes from San Francisco of the death, in utter destitution, of a once telegraph operator, who amassed a fortune of ten millions of dollars through discovering the key to the cipher employed by the four Bonanza Kings in their frequent inter-communications respecting the silver mines in California and Virginia. He speculated and won, and then speculated and lost.

The Yarmouth Electric Railway.—Says the *Eastern Evening News* of Tuesday, Binko's Electric Railway was *un fait accompli*, although it was not carried so far as was intended. It is now a thing of the past however. Binko has left the town, and the inquiries of his friends have, at present, failed to obtain his address. Yesterday morning the rails were taken up by a gang of men, whether for the purpose of being sold to defray expenses which may have been incurred here or not, we do not know, but they are gone, and we suppose the cars will follow. We believe there has been all the way through some difficulty in the way of working the electric railway, the engine at the Aquarium which was used for the purpose not being sufficiently powerful to obtain the requisite power. At the Police Court on Monday morning several of the men who had been employed by Binko, and who have not been paid their wages, asked the advice of the Bench as to what course they should take to recover what is due to them, and they were told to take the matter into the County Court. There are various other claims against Mr. Binko, which will probably lead to legal proceedings.

The Ball Machine.—The Ball electric light machine, we hear, is meeting with great success at the Croton aqueduct, where several are in use 23½ hours out of 24.

Knocked Down by Lightning.—An employé of an electric light company at Portland, Me., was climbing a pole during a thunderstorm, carrying a coil of wire, one end of which trailed along the ground. He received a shock from a lightning flash which sent him to the ground, but he was not seriously injured.

Electrical Transmission of Power in New Zealand.—A Dunedin electrical engineering firm is carrying out a contract for the transmission of power to run a stamping battery of 20 heads. The scene of operations is a gold mine in the mountainous country some 30 miles behind Lake Wakatipu, and the power to run the battery is transmitted from a waterfall in a neighbouring valley, straight over a mountain of about 2,000 feet in height, and for a distance of about two miles. The conducting wire is of the same size as an ordinary telegraph wire, but of copper, and is suspended from telegraph insulators in the usual manner.

The Victoria Hotel, Manchester.—This new hotel, of the lighting of which we gave some particulars a few weeks since, has been fitted throughout with electric bells and speaking tubes by Mr. John R. Wilson, who supplies us with the following figures:—There are 500 bells and indicators. The indicators are the largest in the north of England, and possibly the largest ever made for an hotel. To complete these bells, 34 miles of insulated copper wire have been used, 44,064 bell staples, 12,000 feet of zinc bell tubes to protect wires, and over 6,000 feet of tin speaking tubes, 1¼ inch diameter, some of the distances of these tubes being 600 feet long; a signal electric bell, with double communication, accompanies each speaking tube. The luggage, tea, and passenger elevators are also all fitted up with electric communication and tubes. Great care has been taken in providing for access to all bell wires and speaking tubes: so much so, that out of the whole 34 miles of wire used any individual wire could be drawn out and replaced in case of accident, without damaging paper, walls or floors.

Tramcar Propulsion by Electricity.—In our reference to the locomotive which is intended for use upon the line of the North Metropolitan Tramway Company, we omitted to mention that the gearing is upon Elieson's patent system of lever transmission. The motor revolves upon an axle, which communicates motion to the driving axle through a set of differential mitre wheels, the speed ratio being 1 to 8·5. The reversing motion is accomplished by means of clutches upon these wheels, the motor revolving always in the same direction. The apparatus has been constructed by the Electric Locomotive and Power Company.

Electrical Telltales.—Messrs. Harrison, Cox-Walker and Co. have been asked to supply Messrs. J. and J. Colman, of Norwich, with one of Cox-Walker's electric telltales for 26 stations. These stations will be all in communication with their central fire station in the works, 10 of them being on one circuit, in series, and each recording on the revolving barrel; eight on another similar circuit, and eight stations being on separate circuits. This arrangement introduces a new feature into the telltales, and all stations are worked from one central battery.

The B.T.K. Accumulators.—The manager of the Consolidated Electric Light Company has sent us a copy of "Les Inventions Brevetées," containing data relative to these batteries. The matter is a continuation of a preceding article, and, therefore, to rightly criticise, the whole of the report should be studied. There are several interesting points, however, to which we may draw attention:—After the sixtieth charge the boxes were emptied and 6½ kilos. of powdered material was collected, showing that the loss of weight in the plates for 60 days' working amounted to 1½ per cent., the total weight of lead having been 450 kilos. Is not this rather a novel experiment, and has it yet been tried in this country? The results given appear to be too good. In one test the mean charging E.M.F. for five hours was 43 volts, and the mean E.M.F. during a discharge of five and a half hours 35·55 volts, and in another instance the author speaks of an *efficiency* of 80 per cent. of energy and 95 per cent. in ampère-hours. It is, however, out of the question to go deeply into the matter without the other portion of the report; but we may remark that it is signed by "M. E. Dumas, Director of the Popularisation of Patented Inventions Service." What an imposing title!

The Distribution of Electricity.—We would call the attention of our scientific friends to the letter on this subject in our correspondence columns. The writer is well known in electrical and scientific circles, and anything coming from his pen cannot be lightly treated. We shall probably know in a short time whether the actual results obtained with Messrs. Paris and Scott's transformer compare favourably with the hypothetical example given by our correspondent.

The Newry Tramcar Accident.—The cause given to account for the accident to an electrical tramcar at Newry is that the brake did not act. Could not this disastrous result have been avoided, or so far modified as to give the occupants of the car a chance of escaping free from injury, by reversing the electromotor? The current, it is stated, had been cut off, but would it not have been worth while to reapply it and reverse the motor? This would, probably, have had the effect of checking the speed of the car sufficiently to enable the experimenters to jump off unhurt, even though the motor itself were destroyed.

Double Pole Switches.—Messrs. B. Verity and Sons, of King Street, Covent Garden, have been appointed special agents in this country for the double pole switches, referred to in our correspondence columns, manufactured by Bergmann, Edison and Co.

President of the Board of Trade.—The Right Hon. E. Stanhope, M.P., has been appointed President of the Board of Trade, *vice* the Duke of Richmond and Gordon, appointed Secretary for Scotland.

A Betrothal.—The *Morning Post* announces that a marriage has been arranged between Mr. D. Jardine-Jardine, only son of Mr. James Jardine, of Dryfeholm, Tinwald, and Torthorwald, Dumfriesshire, and Miss Mary Angela Bright, second daughter of the well-electrician, Sir Charles Bright, of Bolton Gardens.

Electrical Inventions for Disposal.—The following patented inventions are advertised in the *Inventors' Mart* for disposal:—An electric fire alarm, auxiliary to the ordinary bell push; an electric signal, purely automatic, on the block system; an electric bell push, to give one, two, three or more rings by a single push; small portable battery, which will run medical lamp of 2 C.P. for 20 minutes, and again after an hour's rest; adjunct to battery, to keep the zincs clean and free from hydrogen. Amongst "inventions wanted" is advertised "any electrical invention." Particulars of above may he had on application to the manager of our contemporary, 1, Queen Victoria Street, E.C.

The Gandy Belting.—This belting has been awarded a medal at the Paris Milling Exhibition, and also a gold medal, the highest award, at the New Orleans Exhibition, where the 60-inch main driving belts were of Mr. Gandy's manufacture.

Personal.—Prof. R. H. Thurston is leaving the Stevens Institute of Technology to assume the position of director of the Sibley College, which has been very much enlarged and enriched through the liberality of the Hon. Hiram Sibley, of Rochester, U.S.A.

Carelessness.—An electric light trimmer while adjusting a lamp in East Boston, on June 30th, met the current when it was turned on and received the full shock. When it struck him he was stunned, and, losing his balance, fell across the bar at the top of the light stand; his wrist, coming in contact with the wire, was severely burned, but he sustained no permanent injury. It is stated that the man himself was alone to blame.

Lectures on the Telegraph and the Telephone.—Mr. T. D. Lockwood, electrician of the American Bell Telephone Company, is to lecture next winter on the telegraph and the telephone before the Lowell Institute of Boston. Mr. Lockwood proposes to illustrate his lectures by several new and striking experiments.

The New Parliament.—It is stated that Mr. Hugh Watt, Chairman of the Maxim-Weston Electric Company, is a candidate for Parliamentary honours. Mr. John Pender, M.P., has intimated his intention of offering himself for re-election for the Wick Burghs.

Telpherage.—We see it stated that the telpherage system is being experimented with in Philadelphia.

Obituary.—News comes from Perth, Western Australia, of the death of Mr. Fleming, superintendent of telegraphs.

Mr. Lever's Safety Lamp Prize.—At the annual meeting of the North of England Institute of Mining and Mechanical Engineers, reference was made to this competition by Mr. Weeks, who said that in the discussion on the Routledge lamp in April last, he referred to the prize of £500 offered by Mr. Ellis Lever for a safety lamp, and stated that that gentleman had taken care to make the conditions under which the prize would be given such as were impossible for any person to comply with. His (Mr. Weeks) intention was merely to give an expression of his individual opinion that the conditions were, in his judgment, incapable of performance. He had no intention to impute want of good faith to Mr. Lever or the adjudicators (who he had since learned settled the conditions), and he now withdrew the words.

The Last Resource.—The editor of a contemporary lay in an unconscious condition, and for some time it was feared that he was dead. "Can't you rouse him, doctor?" was anxiously asked. "No!" the physician replied, "I fear that life is extinct." Then the editor's assistant bent over and whispered in his ear: "A gentleman wants to put an advertisement in the paper." Immediately the unconscious man's face showed signs of returning life, and struggling to a sitting posture, he said feebly: "How many lines?"

The Remington Electric Lighting System.—The City of Rome, Inman line, has adopted the Remington system of electric lighting. The authorities of Oswego, New York, where the Remington system is in use, recently advised a neighbouring city to adopt that system in the following letter:—"Your favour of the 17th instant relative to electric light received and handed me for reply. The Remington lights give us entire satisfaction. We think we have as good, if not the best light in use. We are told so by strangers and travelling men, who have the best opportunity to see the different lights. Twenty of our Remington lights displace 129 gas jets. If you want a good light, get the Remington."

Gaining in Public Favour.—Last May, Mr. N. J. Simmons, of Woburn, Mass., ordered a small Edison central station to be installed in his machine shops in that town for the purpose of lighting them, together with the skating rink and several residences of his neighbours. What Mr. Simmons was about to do soon became generally known, and the idea of using the electric light met with so much favour that the entire working capacity of the plant was sold before the starting up. The gas company of Woburn, on learning of the move made by Mr. Simmons, reduced the price of gas, but this did not interfere with the sale of the electric light, as the sanitary advantages and cleanliness more than compensated for the difference in price. The New England Wiring Company has had charge of the installation.

The Recent Electrical Exhibition at Philadelphia.—The July number of the *Journal of the Franklin Institute* contains the illustrated general report of Col. Charles H. Banes, Chairman of the Committee on Exhibitions. It shows in a clear and forcible manner the great success of the recent electrical exhibition held in Philadelphia. Lectures were given on electrical subjects before the general public and to about 15,000 school children, 80,000 primers of electricity were sold, and a reference library of nearly 3,000 books, pamphlets, &c., on electricity collected and presented to the Franklin Institute for a memorial library. The entire expense of erection of buildings, the cost of shafting, steam-piping and general preparations, as well as the running expenses, were promptly met and a balance of a few thousand dollars was left in the treasury. This was accomplished without government aid or the use of public moneys.

Gas Undertakings.—A return relating to gas undertakings (other than local authorities) in the United Kingdom, was issued on Wednesday. The summary of this shows that in 1884 the total share capital authorised to be raised amounted to £39,575,330, while the total paid up was £29,594,464. The loan capital authorised was £9,395,859, and the total issued £5,330,550. There had been 5,361,576 tons of coal carbonised, and 49,904,217,135 cubic feet of gas sold. There were 12,421 gas mains in miles, and 242,782 public lamps lighted.

A Favoured Company.—We have it on the authority of the *Financial News* that "Edward S. Stokes, the murderer of James Fisk, jun., has been elected President of the American United Lines Telegraph Company."

Not to be put out.—Mr. Royal Wilson, a coloured gentleman who has just been called to the position of head waiter at the Armijo House, because of the illness of the head waiter proper, made a brilliant break the other night. The dining-room of the hotel is illuminated at night by an electric light, and when Mr. Wilson thought that the proper time had come to extinguish the light after supper was over, and there was no further occasion to keep up the illumination, he concluded to put it out. Mr. Wilson was the only man in Albuquerque who didn't know that an electric light could only be extinguished by turning a crank. He was in a state of painful uncertainty as to the proper mode, but finally made up his mind that the simplest way out of a difficulty is always the best. He placed a table under the light and a chair on the top of the table, and mounting the latter, he blew, and blew, and blew at that electric light with all the force of his lungs, but it only winked at him in an aggravated sort of way, and invited him to keep up his lick. He did keep it up until his eyes bulged and the perspiration trickled in rivulets from his features. When he was in a state of utter exhaustion he gave up the job in disgust, and said that light might burn all night if it wanted to.—*Albuquerque Journal.*

Electrical Tramcars in New Zealand.—The Dunedin Tramway Company is, we learn from the *New Zealand Herald*, seriously entertaining the project of running cars by electricity, and is about to have a series of experiments conducted. A director has been sent to this country to enquire into the various systems in actual use. It appears that horse cars in Dunedin cost 7½d. per mile, and the shareholders are said to be determined to move in the matter, and to convert the line into a wire cable system (at a cost of £35,000), or to use electricity, if the latter is practical and cheaper.

NEW COMPANY REGISTERED.

Electric Locomotive and Power Company, Limited.—Capital: £50,000 in £5 shares. Registered office, 6, Great Winchester Street, E.C. Objects: To acquire the interests of the Jarman Electrical Company, Limited, and of Mr. C. P. Eliesen in patents for the production of electricity, and for transmitting motive power from electric motors. Signatories (with one share each): *George Hamilton, Highfield; *P. T. Lironi, Walnut Tree House; *T. Wickham, Cromwell House; Watson Smith, Hainhault Road; W. H. Protherew, Hainhault Road; *C. P. Elieson (electrician), 7, Drayton Road, all of Leytonstone; F. Walker, 36, Spondon Road, Tottenham. Directing qualification: 400 shares. The first directors are the signatories whose names are preceded by an asterisk, and Mr. Richard Cory, of Cardiff. Remuneration: £1,000 per annum, and in any year in which a dividend of not less than 10 per cent. is declared, an additional sum equivalent to 5 per cent. upon the dividend paid. Registered 14th inst. by Mr. Ralph Vincent, of 20, Bridge Row, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Thompson's Electrical Fitting and Screw Cutting Company, Limited.—The statutory return of this company, made up the 22nd ult., was filed on the 12th inst. The nominal capital is £3,000 in £1 shares. 1,506 shares have been taken up, and are considered to be fully paid up. Registered office, 4, Queen Victoria Street.

Simplex Electric Light and Plant Company, Limited.—The annual return of this company, made up to the 13th March, was filed on the 12th inst. The nominal capital is £40,000 in 8,000 shares of £5 each. 3,450 shares have been taken up, and £4 per share has been called upon 2,250 shares, the remaining 1,200 shares being considered fully paid. The calls paid amount to £8,950, leaving £50 unpaid. Since the registration of the previous return the paid up capital has increased £4,500. Registered office, Valley Mill, Eccles, near Manchester.

Liverpool Electric Supply Company, Limited.—At an extraordinary general meeting of the members of this company, held at Crosshall Street, Liverpool, on the 10th ult., it was resolved that the nominal capital be increased by the addition thereto of £190,000 in 38,000 shares of £5 each, beyond the registered capital of £10,000. The resolution was confirmed on the 27th ult., and duly filed on the 12th inst.

Jarman Electrical Company, Limited.—The first annual return of this company, made up the 29th ult., was filed on the 17th inst. The nominal capital is £15,000, divided into 3,000 shares of £5 each. 1,203 shares have been taken up and the full amount has been called thereon, the calls paid amounting to £5,772, leaving £243 unpaid. Registered office, 6, Great Winchester Street Buildings.

LEGAL.

Slatter v. Muirhead.—In the Lord Mayor's Court on Monday, July the 26th, before Mr. Woodthorpe Brandon, the Assistant Judge, and a Common Jury, the case of "Slatter v. Muirhead" was tried. It was an action brought by the plaintiff, Mr. Alfred Slatter, now carrying on business as an electrical engineer at Leadenhall House, Leadenhall Street, to recover the sum of £37 10s. for special services rendered to the defendant while in his employ. The total of the claim was brought up to £39 8s. by £1 18s. being charged for interest. There had been a count in the declaration for £2 10s. for wrongful dismissal, but this had been struck out. The defendant pleaded never indebted. Mr. Lewis Glyn was counsel for the plaintiff (instructed by Mr. Wm. Wild), and Mr. Woodfall for the defendant.

Mr. Glyn, in opening the case, said that the defendant, Mr. John Muirhead, was a member of a firm which at the time of the plaintiff's connection with them was a private firm, but which had since become a limited company. In May, 1881, the defendant employed the plaintiff to attend to his private work. No salary was at first arranged, but it would be shown that the defendant paid the plaintiff sums at irregular intervals amounting to about the sum which was afterwards agreed upon, namely, £30 per annum. The work which the plaintiff was called upon to do was quite apart from his ordinary duties connected with the firm. He understood that the defendant entirely denied any agreement to pay the plaintiff an agreed sum; but how, in the face of the payments which the defendant had from time to time made to the plaintiff, he could support that contention, he (the learned counsel) could not conceive. In fact, the case came before them, practically, as an undefended action. The plaintiff claimed at the rate of £30 a year from January, 1883, to April, 1884, which amounted to £37 10s. Then there was the charge for interest, £1 18s., to which, as a question of law, he submitted the plaintiff was entitled, as there had been a demand in writing for the amount of the claim.

The plaintiff, in his evidence, bore out the opening statement of counsel. The work which he did for the defendant was of a character quite different to the ordinary work of the firm. On one occasion he sold a house for the defendant, and he used to attend to the defendant's transactions on the Stock Exchange, and wrote all his private letters, paid his accounts, &c. The defendant paid him various sums from time to time, and when witness pointed out that he could not go on in that uncertain way, the defendant arranged to give him £30 per annum. The plaintiff was cross-examined at considerable length by Mr. Woodfall, with the object of showing that the work done by him came within the scope of his ordinary duties.

For the defence, the defendant, Mr. John Muirhead, was called,

and denied having ever made any arrangement to pay the plaintiff any settled sum. What amounts he had given him were simply presents. He gave him money at the request of the works manager.

Mr. Glyn (cross-examining): Now, Mr. Muirhead, you are a sharp, shrewd, commercial man; you would not sign any document without reading the contents, especially guarantees?—Defendant: No.

Counsel: Now, Mr. Muirhead, is that your signature (handing him guarantee paper)?—Defendant: Well, it is the signature of the firm.

Counsel: Is it in your handwriting?—Defendant: Yes.

Mr. Glyn: Did the works manager have anything to do with your stockbroking transactions?—Defendant: No.

Mr. Glyn: Or with the cigarettes?—Defendant: No.

The learned Judge, in summing up, pointed out that it was not a question of whether any sum was due to the plaintiff, as there was evidence and proof given that defendant had engaged to pay something, and it was for the jury to say how much was due.

The jury returned a verdict for the plaintiff for the full amount claimed, £39 8s.

Mr. Glyn: That will be a verdict for £37 10s., and £1 18s. interest.

The learned Judge: I question whether you are entitled to the amount for interest, but as the jury have given it you I will allow it.

Judgment accordingly.

CITY NOTES, REPORTS, MEETINGS, &c.

The Lancashire and Cheshire Telephonic Exchange Company, Limited.

THE fourth annual ordinary general meeting of this company was held at the Memorial Hall, Albert Square, Manchester, on Thursday, when the following report of the directors for the year ending 30th June was presented to the shareholders.

The directors have the pleasure to submit herewith their fourth annual report and statement of accounts.

The subscriptions and rentals (including those of the out-districts) pertaining to the financial year amount to £62,160 16s. 9d., as compared with £53,256 3s. 5d. for the year ending 30th June, 1884.

The amount of income carried forward to next year's revenue, as representing sums received in advance for periods extending beyond 30th June, 1885, is £30,577 3s. 11d., against £26,101 6s. 11d. in previous year's balance sheet.

On the past year's working the nett profit is £20,847 2s. 8d., which, with a credit balance of £3,100 15s. 4d., remaining from previous account, makes a total fund of £23,947 18s. Out of this sum an amount of £10,365 12s. 8d. has already been absorbed in the payment, in February last, of an *interim* dividend, and the directors now recommend a further dividend at the same rate, making a complete dividend of 7 per cent. for the year ending 30th June, 1885.

After providing for this dividend, there will remain, at credit of profit and loss account, a balance of £3,216 12s. 8d. The directors propose that £3,000 of this shall be placed to a reserve fund, and that the remaining £216 12s. 8d. be carried forward to next year.

On 30th June, 1884, the total number of subscribers to the various "exchanges" was 2,734, and of private rentals, 828; this year, on the same date, the figures were 3,142 and 907, respectively.

The "exchange" and private line orders on the books at 30th June, 1884, and including work not finished, represented a gross income of £61,149 0s. 6d. On 30th June, 1885, the amount stood at £69,789 13s. 8d., showing an increase of new business in these two sections to the extent of £8,640 13s. 2d., in addition to which the trunk wire and call office departments recently opened are already contributing an income equal to the rate of £4,000 per annum.

As the company's subscribers and the public become more accustomed to the great advantages offered by these new services, it is expected that the revenue therefrom will expand considerably, and form an important item in future income returns.

The £69,789 13s. 8d., previously mentioned, includes an estimated income of about £2,500 per annum, from Birkenhead and several other towns, in which the users of the local exchanges are not as yet being charged subscriptions. It is expected, however, that—with one or two slight exceptions—all the towns where a free trial of the "exchange" system now exists, will be contributing to the revenue before the end of next financial year. To prevent possible misconception, it should be stated that these estimated figures do not appear in any shape in the balance-sheet itself, but are included under the present heading to assist the shareholders in forming an idea of the actual position of the company's business.

Referring to the promises made at the extraordinary meeting of shareholders, held on 9th December last year, when the operation of the new licence granted by the Postal Authorities was explained, the directors have the pleasure to submit, at foot hereof, a map showing the system of trunk wires decided upon, after much anxious consideration of various alternative routes and localities.

The general public from call stations, and the company's subscribers from their own offices (either by a yearly rental, or by a toll of sixpence per message, on credit for monthly account), have now at their disposal a service providing cheap communication by telephone between many of the manufacturing towns of Lancashire and Cheshire. The system of trunk wires in these two counties will be extended as rapidly as circumstances permit; and, by arrangement with the National Telephone Company, Limited, the chief commercial towns of Yorkshire will also be connected very shortly.

Public call stations have recently been opened, for local as well as trunk wire communication, in all the towns of any importance where the company has "exchanges." In these call stations anyone may converse by telephone, not only with subscribers to the company's "exchanges," but also with anybody who, by previous appointment between the parties concerned, has gone to some other call office to receive a message.

The steady increase referred to in last report as occurring in the average daily "calls" made by subscribers is still maintained in Manchester and Liverpool, and is the best evidence that the telephone service is giving satisfaction. It is further encouraging to be able to report that, in several of the smaller "exchanges," there has recently been a marked improvement, both in the number of enquiries for telephones and in the average of "calls" made. No doubt the new trunk wire and call-office services will have largely aided in awakening in these outside towns this increased appreciation. The new switching apparatus at Liverpool, mentioned in last report, has stood the test of the three months' trial, and the application of the same system to Manchester is under the consideration of your directors.

Since last report, the company's telephonic "exchanges" in Manchester, Blackburn, and Preston have been connected with the chief post offices of those towns, and subscribers who arrange for the service may send and receive telegrams direct by telephone, and thus save the time now occupied by messengers. It is expected that on 1st September the same facilities will also be available to the company's subscribers in Liverpool.

American, British and Continental Cable Company, Limited.—The official liquidator of this company, with whom creditors must communicate by October 1st, is Mr. John Ball Ball, of 1, Gresham Buildings, Basinghall Street, E.C.

Great Northern Telegraph Company, Limited.—Messrs. Hambro and Son will pay the interest due September 1st next on the debentures of 1883, Series B.

TRAFFIC RECEIPTS.

The West India and Panama Telegraph Company, Limited. The estimated receipts for the half-month ended the 15th August, are £2,141, as compared with £2,382 in the corresponding period of 1884. The April receipts, estimated at £7,790, realised £7,890.

NEW PATENTS—1885.

9645. "Domestic telephones." G. TRIER. (Communicated by C. Mildé). Dated August 13.

9654. "Telephonic check apparatus for public call-boxes." D. SINCLAIR. Dated August 13.

9655. "Electrical switch." N. G. THOMPSON. Dated August 13.

9666. "Electric arc lamps." E. [C.] STREET, F. V. MACQUAIRE. Dated August 13. (*Complete.*)

9688. "Driving gear for dynamos." H. LINDLEY. Dated August 14.

9696. "Apparatus for transporting cash or parcels, or both, in stores." B. J. B. MILLS. (Communicated by R. A. McCarthy.) Dated August 14.

9706. "Method of and apparatus for producing induced electric currents. C. D. ABEL. (Communicated by J. C. Pürthner.) Dated August 14.

9736. "Electrical apparatus for unfastening doors from a distance." W. H. BECK. (Communicated by G. Godde and H. Gregoire.) Dated August 15.

9741. "Means and devices for telegraphic and telephonic purposes." A. M. ROSEBRUGH. Dated August 15.

9755. "Electric connections to clocks for operating alarums and regulating gaslights." P. POHLMAN. Dated August 17.

9758. "Purifying, separating, and decomposing liquids by electrolysis." H. J. HADDAN. (Communicated by Messrs. Champy.) Dated August 17.

9762. "Portable electric lamps." J. E. LIARDET. Dated August 17.

9795. "Method of telegraphing." F. H. BROWN. Dated August 18. (*Complete.*)

9802. "Telephone receivers." C. A. TESKE. Dated August 18.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1884.

9365. "Improvements in magneto-dynamo electric generators or electro-dynamo magnetic machines." A. SHIPPEY and J. E. WYDER. Dated June 24. 8d. The object of the invention is to obtain the greatest quantity of electromotive force from a given power, and in order to obtain this result, combined with increased surface, the inventors use welded, blended, or compressed steel of very high temperature and hardness and of great resisting power, capable of withstanding more wear and tear, and by the adoption of steel of high temperature the magnets are more reliable to permanent magnetism. The armatures are made of an improved Gramme type, prepared with a perfect insulation cut from sheets of compressed pulverised homogeneous cocoa nut fibre packing, or by any other well known means of insulation, placed between the core and the wire and sections of same. Another feature of the invention is the collecting of the several electric poles of the armature into two external poles, which are then connected through and to a collector and a pair of brushes to the leads, suitably arranged for conveying the currents produced, and in order to obtain this result the inventors connect all the extremities of the same pole sections together and separately from the other sections by means of wire carried inside the hollow part of the armature, the sections of which, independently of being coupled, are connected with the collectors as before described. By this arrangement one brush receives the entire current from all the positive poles of the armature, while the other brush is in contact with the negative poles in a like manner. The inventors also according to the improvements regulate the position of the brushes in a very accurate and precise manner, which brushes are fixed on to a revolving disc or segment, or each brush on to a separate disc or segment, which disc or segment is provided with a rack toothed wheel or wheels which can be worked to and fro by a lever or levers bearing a pinion or pinions working and acting upon the above described racks. A very important and novel feature in connection with the invention is the mode and manner adopted for keeping the good and permanent condition of the magnets, which the inventors do by winding a calculated quantity of wire round and near the poles of the magnets, which wire is suitably insulated from the magnets according to requirements, and by sending a temporary current through that so constructed circuit.

10237. "An electric and magnetic meter." C. D. ABEL. (Communicated from abroad by La Societé Masion Bréguet, of Paris.) Dated July 16. 6d. An insulated tube containing mercury is placed in the magnetic field, which may consist of a horse-shoe magnet, between the poles of which is a block of ebonite, or other suitable insulating material, formed of two longitudinal halves fixed together and having a horizontal channel formed therein, in the ends of which are fixed the ends of two graduated vertical glass gauge tubes, which, together with the insulated channel, form the receptacle or gauge containing the mercury. Two platinum plates are fixed to contact posts secured to the upper and under side of the ebonite block, and have their inner ends in contact with the mercury in the channel, such platinum plates being at right angles to the channel and to the lines of force. An electric current being passed through the two contact posts, platinum strips, and mercury, will produce a force at right angles to the direction of the current and to that of the lines of magnetic force, thereby causing the mercury to move so as to establish a difference of level thereof in the two vertical tubes, which difference of level will be proportional to the intensity of the magnetic field.

10907. "Underground electrical haulage." FLEMING JENKIN. Dated August 2. 6d. The inventor employs any ordinary driving dynamo and service leads to the motor dynamo for the distribution of the power, but he employs a motor dynamo specially constructed in such a way that the brushes and commutator are wholly enclosed in a casing so that the sparks shall not be dangerous in fiery mines.

10990. "Improvements in telephony." C. LANGDON-DAVIES. Dated August 6. 6d. The object of this invention is the use in telephony of line wires through which ordinary telegraphic communications are carried on. in order that the telegraph signal and other currents may not be heard injuriously in the telephone, the inventor connects the telephone with the line by means of an instrument composed of two or more conductors laid together but insulated from each other, one of which conductors is attached to the line, and another to the telephone. Fine copper wire covered with silk or other insulator may be employed. Two or more of these (which may or may not be of the same diameter) are laid together and are then again covered with silk or other suitable material. The duplex or multiple wire thus prepared is usually wound upon a bobbin, but may be made into a flat spiral, or other convenient form. In applying telephones upon a single line wire the inventor usually places the secondary coil of the microphone in the line. He employs two of the duplex or multiple bobbins and connects them with the line wire on opposite sides of this secondary coil (or if this is not convenient, then on opposite sides of a resistance of small dimensions, an ordinary telegraph instrument answers this purpose). Each bobbin is thus connected with the line by one only of its wires, and the other end of this wire remains insulated. The receiving telephone is connected with another wire of each bobbin, and the other extremities of these wires also remain insulated. Thus no metallic connection is established between the bobbin of the receiving telephone and either the line wire or the earth, but the receiving telephone is connected with insulated wires, which are in close proximity to other wires which are in metallic connection at one end with different points in the line wire.

11145. "Improvements relating to the manufacture of incandescing electric lamps." B. J. B. MILLS. (Communicated from abroad by W. Holzer, of America.) Dated August 11. 6d. The flexible carbon conductors or loops of incandescing electric lamps, frequently become bent and irregular in shape during the process of carbonization, and sometimes when raised to high incandescence during the operation of exhausting the globes. The object of the invention is to overcome this difficulty which is accomplished by subjecting the loops to strain while raised to incandescence in a vacuum. This is accomplished while the lamps are being exhausted. A weight is attached to the end of each loop and keeps it under constant strain. When the loop is raised to a high incandescence, as it is at the end of the process of exhaustion, the carbon becomes somewhat plastic, and the weight draws the loop into regular shape, or prevents it from assuming an irregular form. This weight may be a wire with a hook end, and if not heavy enough itself, may have any suitable body attached to it to increase its weight. The wire is passed into the exhaust tube of the lamp and hooked on to the loop, hanging down into such exhaust tube. The exhaust tube is made of sufficient length so that when the lamp is ready for sealing off from the pump a seal can be made in the tube which will leave a tube attached to the lamp as long as the weight. By manipulation the weight is then unhooked from the loop and drops into the tube when the lamp is sealed off from the tube carrying the weight.

11307. "Improvements in electric telephony." J. G. LORRAIN. Dated August 15. 4d. The inventor employs an instrument consisting of a plate, sheet, or mass of non-conducting or other suitable material, suspended, or otherwise suitably disposed, so as to be able to vibrate towards and away from a conductor or mass, plate, or sheet of conducting material. The non-conducting plate may either move bodily towards and away from the conducting plate as a whole, or it may be attached so as only to vibrate towards and away from it as a diaphragm or tympan. The non-conducting plate of the transmitter being electrified or charged by any suitable means, such as rubbing with fur, wool, silk, &c., the air vibrations produced by the voice may be made to impinge directly or indirectly upon it, so as to cause it to vibrate towards and away from the conducting plate. The nearer the charged non-conducting plate approaches the conducting plate in its vibrations the stronger will be the charge induced in the latter: the further the charged non-conducting plate recedes from the conducting plate the weaker will be the charge induced in the conducting plate. The stronger the charge induced in the conducting plate, and conveyed by the conductor to the receiver, the more will the non-conducting plate of the receiver be attracted towards its conducting plate: the weaker the charge conveyed by the conductor the less will the non-conducting plate of the receiver be attracted towards its conducting plate. The non-conducting plate of the receiver will therefore vibrate rythmically with that of the transmitter, and cause mechanical vibrations of the air similar to and uniform with those actuating the transmitter.

11521. "Improvements in electric batteries." J. H. JOHNSON. (Communicated from abroad by P. G. Skrivanow, of Paris.) Dated August 21. 6d. Flat cells of porous material are provided, each containing nitric acid, in which is immersed a plate of platinum or carbon. These flat cells are arranged in a suitable trough or vessel constructed of gutta-percha, ebonite, porcelain, wood, or other suitable material, preferably of rectangular form and containing a solution of sulphate of zinc. Plates of zinc are introduced into this trough or vessel between each two adjacent porous cells, and these plates of zinc are electrically connected together at their lower edges by being placed in contact with mercury contained in the bottom of the trough or vessel or by other equivalent means of contact. This mercury or contact is also connected by a plate, preferably of platinum, to the negative pole. The platinum or carbon plates or electrodes in the porous cells are connected at their upper edges to the positive pole. The upper part of each porous cell is hermetically closed, preferably by means of paraffin wax, through which are passed two tubes (preferably of glass), one of which extends nearly to the bottom of each cell, and is used for supplying the cell with nitric acid, the other tube being much shorter and serving for the escape of air and gases. The arrangement of the electrodes or plates as described presents a large surface to the action of the liquids.

11601. "Electric railways." J. ENRIGHT. Dated August 25. 4d. The object of this invention is to propel and light carriages by electricity. The inventor requires a line of rails, generators of electricity, and motors such as are now in use. The novelty of the system lies in the circuit arrangement, and consists in having a well-insulated conductor fixed in any convenient place near the rails. The end remote from the generator is insulated. Branches come from this main conductor to contact posts, which are set up either between the rails or on either side of them. Normally these branches are broken so as that a current cannot pass through them. When a train comes up to a contact post with which a branch is connected, the break in the branch is made good and a current passes into the train.

11853. "Improvements in secondary batteries." E. G. DORNBUSCH. Dated September 1. 6d. The inventor employs lead plates of suitable thickness, the one to form the support of the anode (charging), being considerably thicker than that to form the cathode (charging), such plates being slit into strips from a short distance from one edge right down to the opposite edge. Each plate is placed in the fold of a doubled piece of felt, flannel, or other suitable absorbent material which will not be affected by the passage of an electric current, or the acid used when the electrodes are used in the battery, such material being cut into strips in the same manner as the plates. A strip of felt, flannel, or other suitable material is then interwoven backwards and forwards, over and under the strips of the covered plate, until the end of such strips is reached, when the felt or flannel is again passed round the plate so as to cover the spaces left exposed when it was passed over and under the strips, such passage for this purpose being preferably in a direction at right angles to the former. The strip and the cover of flannel or felt, before being applied as described, are first impregnated with a salt of lead, which is caused to fill up the interstices between the fibres of the material in any suitable manner, and after being placed on the sheet of lead, the whole is dipped into a paste of the salt of lead (formed as hereinafter described), so as to complete the filling up of the interstices. The plates are then inserted into bags or envelopes of felt or flannel (either prepared as described or not), when the salt of lead can be reduced to a metallic state by making the plates the cathodes in an electrolytic bath, or the plates, without being so reduced, may be immediately placed in the cell they are intended to be used in, and the one peroxidised and the other reduced by charging, as is well understood.

CORRESPONDENCE.

Electric Signalling from Balloons.

I was much amused with Mr. Bruce's letter on this subject. Mr. Bruce must know that once the idea of electrically illuminating translucent balloons was conceived, its application by well-known electric agents was only a question of time and money. If I wished to apply the invention for strategetic purposes and for signalling—as the latter use was not lost sight of by me—I could do so in many different ways without in the least infringing on the just rights of Mr. Bruce; but the development of my other inventions will alone prevent me from doing this, and I hope Mr. Bruce will continue his experiments—he has my best wishes.

Certainly the man who both conceives and developes an invention is deserving of higher credit than he who conceives the idea only, although if the latter gratuitously gives to the public the benefit of the result of his inventive mind from purely patriotic motives, he is then deserving of greater honour.

Many men have the genius to invent or conceive new improvements, but they have neither the means nor the time to develope them—Mr. Bruce is fortunate in having both—and if the honour of the invention of electric signalling by balloons is divided, it is only another illustration of two or more minds far removed from each other, moving in the same direction; it does not detract from the honour of either that the other has conceived the same invention; and it is in the conception where most of the honour lies, as without the germ, how could material evolution exist?

B. H. Thwaite.

August 15*th*, 1885.

Telephonic Charges.

In the ELECTRICAL REVIEW for July 4th appeared a list of telephonic charges on the Continent. It was there shown that the lowest cost to subscribers was at Enschede. I happened to be there at the time and can bear testimony to the thorough and reliable character of the installation. The chief reason for the low tariff is the absence of a Patent Law in Holland, hence Messrs. Ribbink van Bork & Co., the well-known electricians of Amsterdam, can afford to sell their apparatus at a low figure, having to fear no law suits for infringements. There is also the absence of patent fees, &c.

Another reason is that the above firm have splendid machinery for turning out instruments in great quantities.

I thought that the above might be of interest to some of your readers, who perhaps were surprised at such a low charge.

C. J. S.

August 17*th*, 1885.

Double Pole Switches.

It was with pleasure I read in your last issue a letter by Sir David Salomon, advocating the use of double pole switches in installations generally, and more especially where accumulators are employed.

Notwithstanding the many obvious advantages in favour of such switches, they have been but little used in England, although in America, where electric lighting has taken such a firm hold, experience has demonstrated not only the desirability, but, in many instances, the actual necessity of using them.

Whether in large isolated plants or in central station lighting, the larger the number of lamps and the more extended the network of wires, so much greater has been the resulting gain.

The same remarks apply quite as much, if not more, to the use of double pole "safety cut-outs," the additional facility in localising faults much more than compensating for the slight extra cost, and they have the cordial approval of Mr. Musgrave Heaphy, from a fire insurance point of view.

That the advantages obtained are not of a mere hazy but of a material character, is proved by the fact that in all the installations made by the Edison Company in America, nothing but double pole cut-outs and switches are employed.

An efficient switch must always be an important factor in a good installation, and in spite of the multifarious claims to perfection, it is only too well known that but very few switches will withstand the test of time. In a double pole switch considerable difficulty is experienced in constructing one that will fulfil all the requirements of strength, room for wires, good contact, and sharp "make and break," &c., and yet will at the same time be neat and not cumbersome.

The double pole switches which have been now extensively used for some time in America, are manufactured by Messrs. Bergmann, Edison & Co., who manufacture all the Edison electrical fittings.

A considerable number have been supplied for the large installation at the Hotel Metropole, and they have the assurance of the electrical engineer, Mr. Holloway, that with such an extensive run of wires, and with workmen continually damaging them, the double pole "safety cut-outs," more especially, have been of immense service to him in coping with such difficulties.

In all the installations and wiring that our firm is at present carrying out—such as the "Naval and Military Club" and the "Criterion," &c.—nothing but double pole fittings are being used, and I for one am sure that this is a step in the right direction of improved efficiency.

Jno. B. Verity.

August 17*th*, 1885.

Induction or Leakage?

I must apologise for being late in answering Mr. T. Angelo's letter on this subject, but having been away from London I did not obtain the issue of the ELECTRICAL REVIEW which contained "T. A.'s" letter until my return. It seems to me that he has, instead of giving any answer to my query, devoted himself to quoting the circular which I mentioned, without saying one word as to why an earth wire run in the vicinity of a telephone circuit should minimise the evil effects of induction. I am aware that such a method has existed for many years, and have had some little experience with such plans, but I am quite cer-

tain that if he takes either a so-called anti-induction cable with a $\frac{3}{16}$ iron wire run through the centre, or a "belt cable" with a lead-foil conductor over the surface, he will find there is only the same current induced in the earth circuit as there is in the other wires in the cable.

This can be satisfactorily explained by taking an induction coil wound with a tertiary wire, and passing a vibratory current through the primary, when of course an induced current will be set up in the secondary and tertiary wires. Now, on putting the tertiary wire to earth, he will find that he does not "minimise" the induction on the secondary wire to any appreciable extent, if at all.

As to the "belt cables," nobody with any knowledge of what is required in the form of telephone wires can overlook the advantage of this system; but if "T. A." will look further into telephone induction, he will find that there is in reality a practical way of permanently eradicating this trouble, although no existing system of so-called anti-induction cables has done or can do so.

Apologising for intruding on your valued space.

W. I. Sandy.

August 17th, 1885.

Distribution of Energy.

In the communications which have appeared respecting the "Transformers" of Messrs. Paris & Scott one important feature, which constitutes, perhaps, the chief merit of their system, has escaped notice. There is a very essential difference between their transformer and a motor coupled with a dynamo, or even the combined motor dynamo in which the motor and dynamo coils are separate, though on the same shaft, and acted on by the same field magnets. It is on account of this feature that a very much higher efficiency may be expected from their apparatus than from a motor. In the armature of the "transformer" the primary and secondary wires are wound together, and thus the deformation of the lines of force in the field, and the other injurious effects of the current in the armature and the field magnets are scarcely greater when the transformer is yielding its full current than when it is running with no lamps attached, and absorbing only ½ H.P. (say) in overcoming mechanical resistances and exciting the field magnets. For example, suppose that there are 10 turns of primary wire in the armature for every turn of secondary, and we may also suppose that the secondary wire has 10 times the sectional area of the primary, which will give the same weight of copper to each. If the resistance of the primary wire is 2 ohms, that of the secondary will be ·02 ohm. Suppose the machine is constructed to supply 100 ampères (including the field magnet current) at 98 volts. Then, when yielding its full current, the E.M.F. in the secondary circuit will be exactly 100 volts. But the secondary wire is wound with the primary, and the E.M.F. in each turn of the primary will be equal to that in each turn of the secondary. Hence there will be an E.M.F. of 1,000 volts opposing the primary current. The E.M.F. at the terminals of the primary wire must be sufficient to balance this, and to send the primary current through the armature. Now as to the magnitude of the primary current. It is clear that a current of 10 ampères in the primary wire will exactly balance the 100 ampères in the secondary wire so far as the mechanical action of the magnetic field upon it is concerned; that is to say, if the magnets were separately excited, and if currents of 10 ampères and 100 ampères were maintained in the primary and secondary coils respectively, the armature would have no tendency to rotate in either direction, and would require the same expenditure of power to keep it rotating at any speed, as though there were no current in either coil (assuming, of course, that these currents are in some way maintained notwithstanding the rotation). Suppose, then, that to overcome the mechanical resistance and maintain the full speed of rotation when the field magnets are separately excited and there is no current in the secondary coil, a current of ·4 ampère in the primary were required. Then when there is a current of 100 ampères in the secondary, a current of 10·4 ampères in the primary will be sufficient. Of this current 10 ampères will be exactly balanced in all inductive effects by the 100 ampères in the secondary, and only the ·4 ampère would remain to produce all the injurious inductive effects to which motors and dynamos are subject, and this excess would be the same whether the current in the secondary were large or small. Suppose the resistance of the field magnets to be 49 ohms, which is nearly a third proportional to the secondary coil of the armature and the lamp circuit. The condition of affairs when the 100 ampères are flowing in the secondary will then be as follows:—

Electromotive force at terminals of primary ...	1020·8	volts.
„ „ in secondary circuit ...	100	„
„ „ at terminals of secondary	98	„
Current in field magnet coils	2	ampères.
„ „ external circuit	98	„
Power received by transformer (ε c)	10616·32	watts.
„ wasted in heating primary (c^2 r) ...	216·32	„
„ employed in driving machine	400·00	„
„ „ „ generating secondary current	10000·00	„

The 10,000 watts thus placed to the debit of the secondary circuit are thus accounted for:—

Wasted in heating armature coil	200	watts.
„ „ magnet coils	196	„
Available in lamp circuit	9604	„

The commercial efficiency of the transformer, if these figures were realised, would be $\frac{9604}{10616{\cdot}32}$ or 90·5 per cent.

If a separate motor and dynamo were employed for this transformation there would be a current of more than 10 ampères instead of ·4 ampère in the armature to magnetise the core, re-act on the field magnets, and produce the usual evil effects in the motor.

K. T. L.

August 17th, 1885.

[We should indeed be pleased to learn that the figures assumed by our correspondent are borne out in actual test, for the advantages of continuous over alternating currents are too well known to need any special recommendation.—EDS. ELEC. REV.].

Culley's Hand-book of Practical Telegraphy.

On reading through the new edition of the above handbook, I observe on page 320 the statement that electro-magnetic retardation is got rid of in the receiver coils of the Wheatstone automatic fast-speed instruments by double-winding them, *so that the extra currents shall flow in reverse directions in the two coils of a pair, and consequently neutralise one another.* I find also that the same statement is made on page 303 of the fifth edition of Preece and Sivewright's "Telegraphy." This explanation seems to me to be entirely incorrect, as it might as well be argued that if two equal cells of a battery are joined up in multiple arc on a line no current would flow, as the two cells would neutralise one another. Possibly, however, I have not rightly understood the statement to which I refer; if so, I should be glad to be put right in the matter.

Telegraphist.

[Our correspondent is perfectly right in supposing that the two extra currents do not *neutralise* one another. The statement in the books in question is incorrect and misleading. The effect of joining up the coils in multiple arc (which is the arrangement adopted) is simply to *reduce* the strength of the extra current, just in the same way as the current given out through a resistance (exceeding that of the battery) by two cells joined in series would be reduced if these two cells were joined up in multiple arc, the total electromotive force of the battery (of two cells) being, in fact, reduced from two to one.—EDS. ELEC. REV.]